ENGINEERING AND MINING JOURNAL

A McGRAW-HILL PUBLICATION

JANUARY 1960

PRICE ONE DOLLAR

FOUNDED 1866

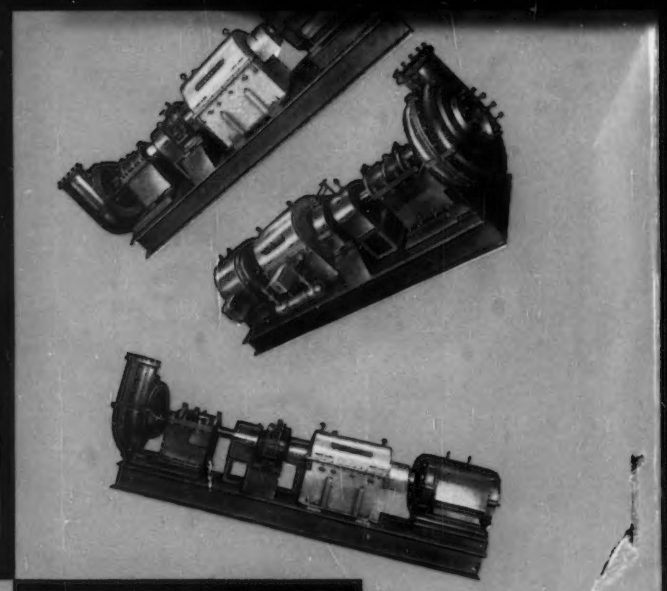
STOPING method manual controls ore grade at Algom Nordic. . p 70

OVERBURDEN REMOVAL at the Nchanga pit is speeded with a bucket wheel-conveyor system layout. p 88

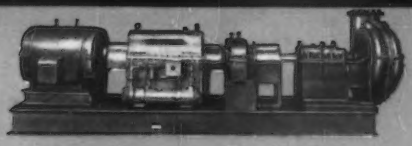
MINING Nevada sandstone at Simplot. p 90

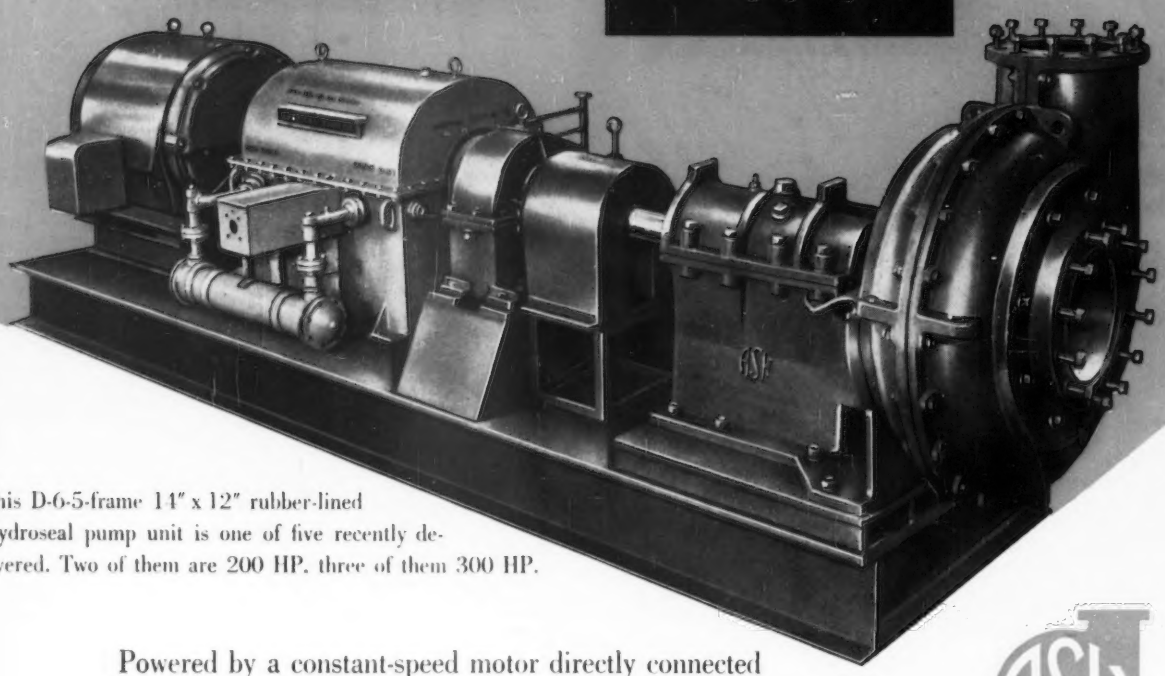
See E&MJ's new contents pages. pp. 2, 4, and 6

Completely engineered pumping unit for abrasives



at any angle... for any purpose





This D-6-5-frame 14" x 12" rubber-lined Hydroseal pump unit is one of five recently delivered. Two of them are 200 HP, three of them 300 HP.

Powered by a constant-speed motor directly connected through a gear-reduction unit to a variable-speed fluid drive, this Hydroseal pump assembly meets wide variations in head and volume. Already operating successfully in America and in Japan, this development may solve your tough pumping problem. Write us.

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at Newkirk Coal Mining Co.

To speed blast-hole drilling in hard overburden, Newkirk Coal Mining Co., Tamaqua, Pa., purchased a crawler-mounted DM-3 Drillmaster in 1957. This heavy-duty unit with the new Ingersoll-Rand DOWNHOLE drill proved so successful that a second Drillmaster, also with DOWNHOLE drill, was added in 1958. The latter was a TRUCM-3 unit with the rugged and roadable Crane Carrier truck designed especially for Drillmaster service. Both machines are used for primary blast hole drilling and fast mobility and easy setup of the TRUCM-3 unit makes it ideal for the company's other near-by operations.

Rock being drilled ranges from soft shale to extremely hard gray siliceous sandstone, but the DOWNHOLE drill maintains high penetration in any type of ground, for holes from 40 to 125 feet in depth.

For coal stripping or any other open-pit blast hole work, the Ingersoll-Rand Drillmaster and revolutionary DOWNHOLE drill make a combination that has no equal for sustained high production at lowest overall cost. Ask your Ingersoll-Rand representative for complete information.

These two I-R Drillmasters, DM-3 on left and TRUCM-3 on right, average better than 140 ft. per 7 hour shift in siliceous sandstone so abrasive that Carset bits were reground every 25 feet.

5-950

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11 Broadway, New York 4, N. Y.

A CONSTANT STANDARD OF QUALITY IN EVERYTHING YOU NEED FOR ROCK DRILLING

Mining Calendar

Annual meeting, AIME, New York, Feb. 14-18, 1960

Australian Institute of Mining & Metallurgy, Adelaide Branch Symposium on Hydrometallurgy, "Wet Processing of Minerals and Industrial Products," Feb. 16-19

Governor's Industrial Safety Conference, statewide meeting, San Francisco, Calif., Feb. 16-17

Symposium on Pilot Plants in Metallurgical Research and Development, Jamshedpur, India, February

National Western Mining Conference and Exhibition. Denver Hilton, March 17-19

Fifth International Mineral Processing Congress, Westminster, London. The Secretary, Institution of Mining & Metallurgy, 44 Portland Place, London, W.1, England. April 6-9

Fifth Annual Mining, Minerals and Petroleum Conference, sponsored by Alaska and Southwest Alaska Sections, AIME, and University of Alaska. On the campus at College, Alaska, April 11-13

Southwest Metals & Minerals Conference, AIME, Los Angeles, Calif. April 21-23

Gold and Money Session, 1960 Pacific Northwest Metals & Minerals Conference, AIME, Portland, Ore., April 28-30

International Congress on Research into Ground Control and Rock Mechanics, Paris, France, May 16-20

Wyoming Mining Association, Jackson Lake Lodge, Wyo. June 10-11

XXI International Geological Congress, University of Copenhagen, Denmark. American Geological Institute, 2101 Constitution Avenue, N.W., Washington 25, D.C. Aug. 15-25

Coming Up

Toquepala—the mammoth copper project in Southern Peru, will be the main feature in the April issue. For the first time, E&MJ will publish full-color photographs of an operating mining plant, accompanying a thorough report on the men, the machines and the techniques which are building a $230-million installation.

Next month—the Annual Survey & Outlook issue. Comprehensive coverage of the major metals and minerals of the world for 1959, with some educated guesses on what to expect in 1960.

Also scheduled—Kennecott's new electrolytic copper refinery at Baltimore . . . "Action in a Rod Mill," by Fred C. Bond.

93rd YEAR OF PUBLICATION

ENGINEERING AND MINING JOURNAL

JANUARY 1960

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B.F.Goodrich

Belt takes a giant step

B.F.Goodrich improvements in rubber brought extra savings

POURING up that steep grade is a never-ending stream of rock—waste from the coal preparation plant in the valley. It's carried by a conveyor belt, at the rate of 400 tons an hour, almost a third of a mile to the top of that 500-foot high ridge. Ordinarily it would take at least three or more belts to lift heavy loads like this so far. But this B.F.Goodrich belt does it in one hop—and at a terrific saving.

In this exclusive B.F.Goodrich conveyor belt design, individual steel cords run lengthwise in the belt. Each cord is completely surrounded and cushioned by rubber so that it can stand the impact of heavy loads. These parallel cords give tremendous strength, yet are flexible so that troughing is natural.

Because of its steel cord construction, the B.F.Goodrich belt can do the job of three or four belts on this high lift, long distance installation. It eliminates the transfer points necessary with a conveyor system built in several stages with ordinary belts, saving money on the original installation and in reduced maintenance costs.

This B.F.Goodrich steel cord belt has been in operation nearly two years and is expected to give many more years of service. A similar belt carrying ore on the Iron Range is in its 11th season, has lasted longer than any conveyor belt ever made with steel cords or cables.

Your B.F.Goodrich distributor has exact specifications for the B.F.Goodrich belt described here. And, as a factory-trained specialist in rubber products, he can answer your questions about the many rubber products B.F.Goodrich makes for industry. *B.F.Goodrich Industrial Products Co., Dept. M-775 Akron 18, Ohio.*

B.F.Goodrich *conveyor belts*

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Articles in this issue of

ENGINEERING AND MINING JOURNAL

Continued from p 2

70 **How Algom Operates a Jackleg Stope**

The mine engineer at Algom Uranium's Nordic Mine, Leslie H. Browne, tells how the property at Elliot Lake, in Blind River has spelled out the technique for stoping. The secret is a manual, simply and explicitly written, which serves its training and operational function superbly and also accomplishes one of the major feats of today's mine administration—to "take care of the ordinary . . . and leave time and room for the supervisor to take care of the extraordinary."

80 **Selecting Stainless Steel: Part II**

Mr. Paret continues his study, began in the December issue (p 106) and further outlines the cost cutting performance of stainless steel in given situations in the mining industry. The article also includes tables and a suite of photographs from the files of E&MJ's editors, taken on various occasions at several U.S. mines and plants.

88 **Wheel and Belts Strip the Nchanga Pit**

The striking picture on the cover and on p 89 typifies the imagination and energy now going into earthmoving all over the world. The night photograph of the digging wheel at work in the pit first appeared in the NCHANGA NEWS, and is reprinted with their kind permission. The supporting artwork and information is principally from Hewitt-Robins Co. and from Nchanga.

22 **Northwest Mining Association's Annual Meeting**

The feature news article this month is given over to coverage of one of the most productive regional industry meetings in recent history. The whole range of mining today, from circular shafts and other operating methods, through technology and geology to the economic situation of the industry in world was studied, discussed and explained. On-the-spot coverage of the meeting, including the points which inspired the greatest discussion and some of the people who took part, begins in "This Month in Mining."

85 **Orinoco Mining Speeds Stockpile Operation**

When iron ore stockpiled at dockside from the huge Cerro Bolivar deposit had to be increased, Orinoco Iron Ore Mining Co. had to install a system to move the material quickly in spite of its tendency to assume a steep angle of repose and stay put. The answer was a versatile scraper, designed for the job.

69 **Taking a Look at the Gold Situation**

For many years, the mining industry, at nearly all of its official and unofficial sessions, has been telling itself that there has to be an improvement in the U.S. gold situation. This month's Editorial suggests that we stop telling each other about it, and devote our strength to a realistic appraisal, followed by a concrete first step toward solution.

(Continued on p 6)

Made its Reputation in the **SCHOOL OF HARD KNOCKS!**

Roebling SH-D Portable Power Cable

From its rugged, abrasion and weather-resistant Roeprene® Sheath, right to the heart of its extra-flexible conductors, Roebling SH-D Portable Power Cable was designed to give full-power performance. The extra quality features show you why Roebling SH-D is better in terms of superior service, ease of installation and maintenance. For more facts, write Roebling's Electrical Wire Division, Trenton 2, New Jersey.

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Extra—Special semi-conducting tape around each super-flexible, stranded conductor to prevent ionization.

Extra—Butyl conductor insulation for outstanding electrical properties, plus heat, moisture and ozone resistance.

Extra—Free-riding, all-rubber fillers for moisture resistance, splicing and terminating ease, unusual flexibility.

Extra—A combination of properties which permits operation with copper temperatures up to 90° C.

93 YEARS OF MINING

The following news items are reprinted, substantially as they first appeared in the AMERICAN JOURNAL OF MINING, the publication which subsequently became the ENGINEERING & MINING JOURNAL. The column will appear in this space monthly.

ARIZONA, APRIL 1866—A letter from William Thompson, superintendent of the Great Central Mine, La Paz: The Indians at Big Bug set fire to a miner's cabin a few nights since, in which two miners were sleeping. One of the two miners was badly shot with arrows as he ran out, and cannot recover. Three soldiers, deserters from the Native Arizona Cavalry, visited a place about 80 miles from here, on the road to Prescott, where two men were digging a well, and had what they wanted to eat and drink. After one of the men went down the well, they shot the other, and he fell into the well dead, his body going to the bottom—eighty ft. They then took what they wanted and left. The mail-carrier, Mr. Duff, found the other man in the well alive. One of the murderers came into La Paz last night and we have him chained to a blacksmith's anvil, having no jail to confine him in.

WASHINGTON, APRIL 1866 — An effort is now being made in Congress, which will doubtless be successful, to remove the Branch Mint now located at Charlotte, N. C., to Boise City, Idaho. Also, to open a new land office at the same place.

DENVER, APRIL 1866 — From the 16th inst., the Holliday Mail and Express Co. will run a daily mail from Topeka to Denver by way of the Smoky Hill route. The overland mail, by the Platte route, has been so overloaded with letters, that it has for two years been impossible to get a transient newspaper through without payment of letter postage. We fervently hope this discriminating and obnoxious feature will now be cancelled.

DETROIT, MARCH 1866—The Detroit Board of Trade have adopted a memorial to Congress, asking an increase of duty on copper, so as to protect the copper interest of Michigan.

This month in

ENGINEERING AND MINING JOURNAL

Continued from p4

Behind the By-Lines

If all of our gears have meshed, this column should be starting the new year as part of an expanded, brightened and more useful "Contents" section of E&MJ. Thanks to the hearty effort and still unfrayed tempers of our Art Director, Art Department, printer and Copy Editor we've gathered material which belongs in the front of the book, and wrapped it, we hope, in a better package.

One of the brightest additions to the new section is the column at the left. It is a happy coincidence that mining as we know it, and this magazine, both began in the year following the Civil War. We've culled the early issues of the paper for the notes at left, and will continue to do so each month.

Our Man in Charge of Culling has resisted the temptation to restyle the news notes to today's idiom, and has also resisted correcting the occasional errors. For instance, we feel rather sure that the editor in 1866 meant "discriminatory" in the third item when he said "discriminating." That, or he'd had a sudden attack of professional candor and a moment of self-doubt.

Another innovation (on p 2) is the "Coming Up" column. We figure you'd like to know what's in the works for future issues of E&MJ, and what to expect of its coverage of the industry.

One of the most exciting issues in some time is set for April with the story of Southern Peru Copper's Toquepala Project. Our Mr. Knoerr spent several weeks on the spot last month, and is at work now on the drawings and flowsheets which will tell the story to you. He's shown here performing one of those odd functions that make a story.

The full color photographs which will accompany the Toquepala issue were taken by Ray Manley, the brilliant young photographer whose work appears regularly in ARIZONA HIGHWAYS. To get the quality that is Ray's hallmark, a lot of paraphernalia must be moved to a lot of difficult places. Manley needed a paraphernalia-packer, and there stood Our Mr. K. That's him in the foreground, and Toquepala in the distance.

The feature articles in this issue, and in subsequent issues, will be discussed on page 4. It's all part of a new presentation which we hope will make E&MJ more useful to you each month and as a reference for the future.

The inclusion of the "Mining Calendar," a standing feature of the news section in this section is also planned to keep you up to date on regional sessions of interest.

We have taken great consolation from a framed motto which our old friend the beachcomber has passed on:

"Good judgment comes from experience.
—And experience comes from bad judgment.

Cut your lube inventory in half, and, in effect, your lube rig has twice the capacity, twice the usefulness, it had before — and experience proves that a Texaco Simplified Lubrication Plan can trim your lube inventory by as much as 50%.

Double the usefulness of your lube rig

You can make your present lube rig twice as valuable as it ever was before – with a Texaco Simplified Lubrication Plan. Here's how:

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A planned inventory of only six lubricants can save you money every time you service your equipment. Application routine is simpler, with far less chance of using the wrong lubricant. And you save valuable manhours because low inventory minimizes handling, storage, and extra paperwork.

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TEXACO

Throughout the United States
Canada • Latin America • West Africa

1959 has been a paradoxical year. With the public press reporting good business for the country as a whole, it has taken a discerning student to discover that the part of the economy relating to capital goods has only bettered to a modest degree. This fact, plus the low carry-over of orders from 1958, caused us to have an unhappy year financially.

However, with the modest but positive increase in business in the U.S.A. and the substantial increase in orders for most of our overseas areas, we look forward with confidence to 1960. Improvement of efficiencies in all internal departments has also been positive and is continuing both as to costs and the time it takes to do things. This naturally will be beneficial to our customers.

SANITATION—Once again this segment of our operations has played a dominant role in our worldwide business during the past year. Orders were placed with us and our subsidiaries to serve larger centers of population such as Trenton, New Jersey; New York City; Bagdad, Iraq; Chicago, Illinois; and Elizabethville in the Belgian Congo, as well as for smaller municipalities from Pierrefond, Ontario to Albertville, Alabama and from the Villa Carmen housing development in Puerto Rico to Harlingen, Texas. Two large U.S. corporations also will install D-O equipment in treatment plants constructed for a research laboratory in New York State and a West Virginia townsite.

Further proof of widespread acceptance of our newer developments is installation of a SpiroVortex system at Checotah, Oklahoma and of CompleTreator units at industrial plants, recreation centers, housing developments and military sites in the United States. Abroad, our Dutch subsidiary will install one of these units in a concrete rather than steel tank, and the first CompleTreator unit has been purchased in the Philippines. The latter, for a large refinery, represents the first export order for our manufacturing representative in Malaya.

New applications of proven equipment include use of the ODS pump for handling conditioning lime for sewage sludge filtration and fabrication of a plastic sludge filter. Also, development work continues on additional applications of our industrial equipment in the sanitary field.

SUGAR—Orders from new and expanding cane sugar factories in India for RapiDorr Clarifiers and Oliver-Campbell Filters contributed significantly to the business of our subsidiary in that country. And in other locations around the world—Mexico, British Honduras, Egypt, Mozambique and Swaziland, for example—these two units continued to be accepted as standard in the industry. In beet sugar, a British producer purchased First Carbonation Thickeners and Vacuum Filters for two new mills; and two Italian mills will use a total of four Vacuum Filters.

PETROLEUM—A variation of the initial application of the DorrClone Desanding System in fresh water treatment is the desanding of salt water used to recharge wells for secondary oil recovery at a West Coast location. Outside the U.S. our Japanese representative is fabricating filters for use in a catalytic cracking process and our British company will supply oil-water separators for both British and Brazilian refineries. Also of interest is equipment for a pilot plant to recover oil from tar sands.

PROJECT ENGINEERING—This phase of our operations was also particularly active in 1959 as design of phosphoric acid plants to be located in Idaho, Great Britain and Ireland and a phosphoric acid and triple superphosphate installation for Brazil was commenced. Also in the fertilizer field was a contract for process modification of a large British plant.

Late in the year, work was started on design of a large limestone crushing plant for which D-O will also purchase equipment and other materials. Our French subsidiary and domestic company working jointly virtually completed design of a large Yugoslavian copper concentrator. Two smaller but nonetheless significant projects—both including laboratory testing and feasibility studies—involved production of a limestone substitute to be used for self-fluxing sinter in blast furnace operation and the recovery of nickel from waste pickle liquors.

WATER—Conventional pre-treatment equipment will be utilized at D-O supplied water plants for a new steel mill in India, a military camp in Iraq and the municipalities of Wilmington, Delaware; New Castle, Pennsylvania; Saida in Lebanon; and Maracaibo and Naiquata, Venezuela. Next year new PeriFilter systems will go into operation at New Oxford and South Pittsburgh, Pennsylvania and in 1959 a large system with two Hydro-Treator mechanisms went on line treating Midland, Michigan's water supply.

FLUOSOLIDS SYSTEMS—One of the new applications of the FluoSolids System this year has been preheating coarse shale in a special three-compartment reactor to produce light-weight aggregate. A second is drying iron ore before magnetic separation and concentration. Currently, the iron ore industry appears to have other drying applications ideally suited to fluidization. FluoSolids roasters are also under construction for a Canadian smelter where only partial sulfur removal is required.

Projects involving already proven applications have included in 1959 a pyrite roaster for a sulfuric acid plant on Formosa, three systems marketed by our Italian subsidiary for roasting pyrite to produce sulfur dioxide for pulp mill bisulfite cooking liquor and for a large zinc roasting installation in Yugoslavia, a large coal dryer for a Western producer, a copper-cobalt roaster in the Belgian Congo and detergent dryers in the United States.

METALLURGICAL—As in past years our work in this area has involved virtually all of the metallic minerals from gold to iron ore. The latter field has been among the most active with purchase of Sizers and Filters for Canadian washing plants, DorrClone classifiers for desliming prior to flotation and Thickeners, Filters and Pumps for recovery of blast furnace flue dust.

PULP AND PAPER—A new tool for this industry is a novel pressure washing filter. Installation of the first U.S. manufactured unit is being made in a Southeastern pulp mill. Ideally suited to brownstock washing, the unit has a number of advantages from both the operating and installation standpoints.

Recausticizing systems including process flowsheet innovations, such as precoat operation of the Lime Mud Filter and application of a two-compartment White Liquor Clarifier with special feedwell, were purchased for new or expanding mills in Canada, India, the United States, Portugal, Japan, Yugoslavia, Scandinavia and the Philippines.

Around the world the American Saveall continued to be recognized as the major means of recovering paper machine fibers from white water and in the U.S. the largest bleach tower designed to date will soon go into operation. An unusual and interesting application of the Merco Centrifuge is recovery of by-product material used as a drill mud dispersant at a West Coast mill.

CHEMICAL—During the year applications of the Plastic Filter, first introduced in mid-'58, were broadened to include a variety of fine chemical and pharmaceutical separations and washing of acid leach liquors from metallurgical pulps. Also in the realm of new applications is dewatering of various plastics using the Mercone Screening Centrifuge.

As usual, our standard line of equipment played a major role in a great number of Italian chemical plant expansions and in large new or expanded facilities in France, Germany, Spain, Mexico and here at home.

FOOD PRODUCTS—Successful application in 1958 of the Mercone-Precoat Filter combination for apple juice processing has resulted in orders from two West Coast packers for similar stations.

In starch, several domestic and overseas producers will employ D-O centrifugals of virtually every design for current modernization and process modification projects. Our Dutch subsidiary has put into operation three corn and potato starch washing and processing plants in Germany and Finland.

NON-METALLICS—A new clay and sand plant in Idaho will utilize considerable D-O sedimentation, filtration and centrifugal classification equipment and a Pennsylvania limestone producer has purchased Classifiers and a large Thickener for installation in an earthen basin. Also in the clay industry, the longest Oliver drum filters ever fabricated—24 feet in length—will be shipped early next year to a Southern producer.

We have noticed with much concern the apparent growing tendency of many users of services and equipment to buy almost exclusively on price rather than on demonstrated product quality and the essential engineering services made available to them during planning and after installation. This is not a new subject—and one on which there has been much forceful editorial comment in the technical press.

This practice confronts the supplier with the practical short range choice of sacrificing product quality and needed engineering, losing the business, or taking it at a loss. For our own part, we do not propose to fall into this trap which, economic considerations aside, can only result in arresting technological advance and which could have a profound effect on the leadership of the free world in things technical.

J. D. HITCH, JR.
Chairman of the Board

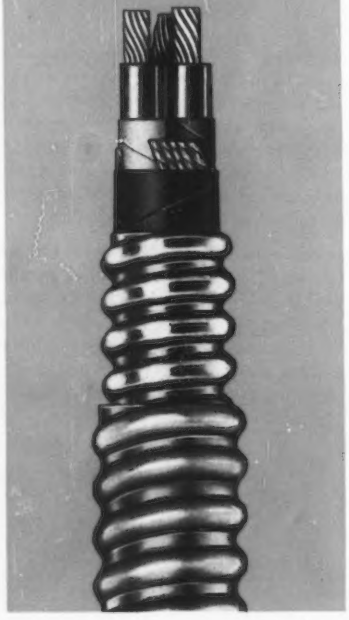
December 1, 1959

RapiDorr, SpiroVortex, CompleTreator, DorrClone, Hydro-Treator, FluoSolids, Merco, Mercone, T.M. Reg. U.S. Pat. Off.

C-L-X INTEGRATED CABLE SYSTEM

Requires no separate Duct or Conduit in any environment

Unusual pliability of C-L-X Sheathed Cables is shown here as the cable is being installed.



The revolutionary C-L-X Continuous, Corrugated, Lightweight, metallic sheath, that Simplex introduced to this country two years ago, is now available in *Aluminum*, *Copper* or *Bronze* as well as the enormously successful *Steel*.

Simplex C-L-X pliable cable systems provide unexcelled ease of installation and mechanical protection.

The *corrugated* metal sheath combines pliability for ease of installation with very great strength and seals the cable against penetration by oil, chemicals and moisture.

Depending on the environmental conditions of the installation, these power, control and communication cable systems can be furnished with or without plastic jacketing.

Light, and pliable, C-L-X cables are easily installed, and require no special reels.

Now, with corrugated *Aluminum*, *Copper* or *Bronze* sheathed C-L-X cable systems, the low resistance of these metals permits designs where the sheath may be used as a neutral or ground. These metals also permit the use of single as well as multiconductor cable assemblies in a-c power systems.

For complete details on C-L-X sheathed cables, contact your Simplex Engineer, or write direct.

See C-L-X in Steel, Copper and Aluminum at the PLANT MAINTENANCE SHOW BOOTH NUMBER 212

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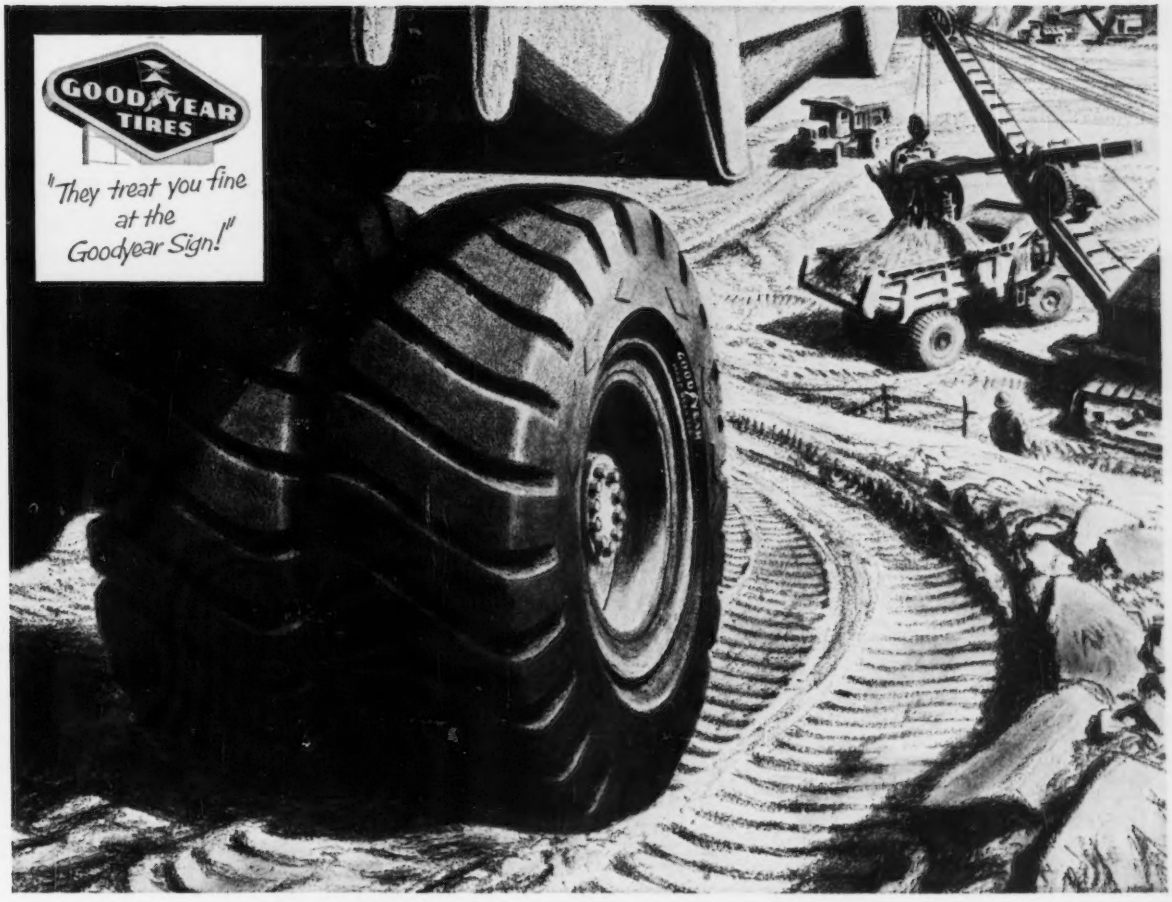
WIRE & CABLE COMPANY

79 Sidney Street, Cambridge, Massachusetts

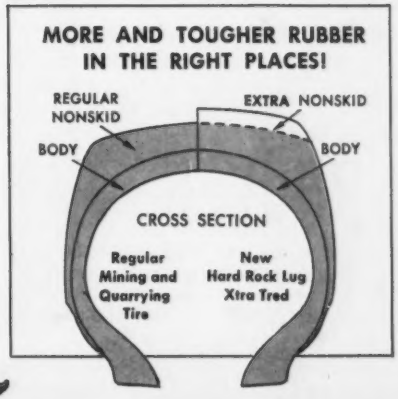


EXTRA TREAD TO TAKE IT WHERE THE GOING'S EXTRA TOUGH!

NEW HARD ROCK LUG XTRA TRED

Specially Engineered Tire for Mine and Quarry Work

More and tougher rubber in the right places—exclusive Triple-Tough 3-T Nylon Cord to back it up. That in a word is why this great new Goodyear tire tops its class. Specifically designed to take the hard knocks, the Hard Rock Lug Xtra Tred—with 18% more tread rubber, reinforced lugs, bonus shoulder heft and huskier sidewalls—stands up under tough punishment that kills lesser tires in short order. And thanks to 3-T Nylon Cord, greatest tire saver in 24 years, cuts, bruise-breaks and blowouts are reduced to an all-time low. Get full details from your Goodyear dealer now. Goodyear, Truck Tire Dept., Akron 16, Ohio.



GOODYEAR

Xtra Tred—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

MORE TONS ARE HAULED ON GOODYEAR TRUCK TIRES THAN ON ANY OTHER KIND

EFFICIENT...

WILLISON COUPLERS

The Willison has only four moving parts.

SAFE...

WILLISON COUPLERS

No need for men to go between cars to couple or uncouple.

STRONG...

WILLISON COUPLERS

Coupler head and shank are one-piece steel casting with over 400,000 pound ultimate strength.

VERSATILE...

WILLISON COUPLERS

Used on all types of mine cars and locomotives; with accessories, can couple with link-and-pin hitchings; can be used with cables on incline haulage or odd pulling requirements.

PROVEN...

WILLISON COUPLERS

Over 100,000 Willisons in service in the U.S. and overseas.

- Rubber Cushioned Units
- Mine and Industrial Car Trucks
- NACO Steel Wheels
- NACO Steel Links and Swivel Hitchings

NATIONAL MALLEABLE and STEEL CASTINGS COMPANY

Established 1868

Transportation Products Division
Cleveland 6, Ohio

International Division Headquarters
Cleveland 6, Ohio

Canadian Subsidiary
National Malleable & Steel Castings
Company of Canada, Ltd., Toronto 1, Ontario

AA-9762

"Best Machine I ever had!"

That's what superintendent Ivan Hunter of the Pacific Silica Company, Ltd. of Oliver, B.C. says,

"Best machine I ever had and there's nothing tougher on a machine than silica dust."

This is the second Northwest, Pacific Silica has bought—a definite testimonial to the high performance of Northwest equipment in this rugged work.

These Northwest ¾-yd. rigs are fast. They have a definite place in mining. Their speed and dependability fit them to the problems of small mines and in large operations they get in and out of places where larger rigs can't go to take care of pockets, do road-work and handle material at the mill.

Your Northwest is a *real* Rock Shovel. It brings you advantages for heavy digging often found only in larger machines. The Northwest Dual Independent Crowd utilizes force wasted in most independent crowd shovels. Booms are rugged to take the shocks of workhorse digging. The Feather-Touch Clutch Control gives the feel of the load while bringing ease to operation. Uniform Pressure Swing Clutches take the jerks and grabs out of swinging, bringing accuracy to spotting loads and reducing spillage. Crawlers are long and wide for stability. Grouped lubrication simplifies upkeep. These and many other features combine for high output in a ¾-yd. machine. Northwests from ¾-yds. to 3-yd. capacity are serving some of the largest mines in the United States and Canada. If you are considering expansion, you should find out about Northwest equipment before you buy.

CRANES
SHOVELS
DRAGLINES
PULLSHOVELS
TRUCK CRANES

3/4 to 3 Cu. Yd. Capacity

NORTHWEST

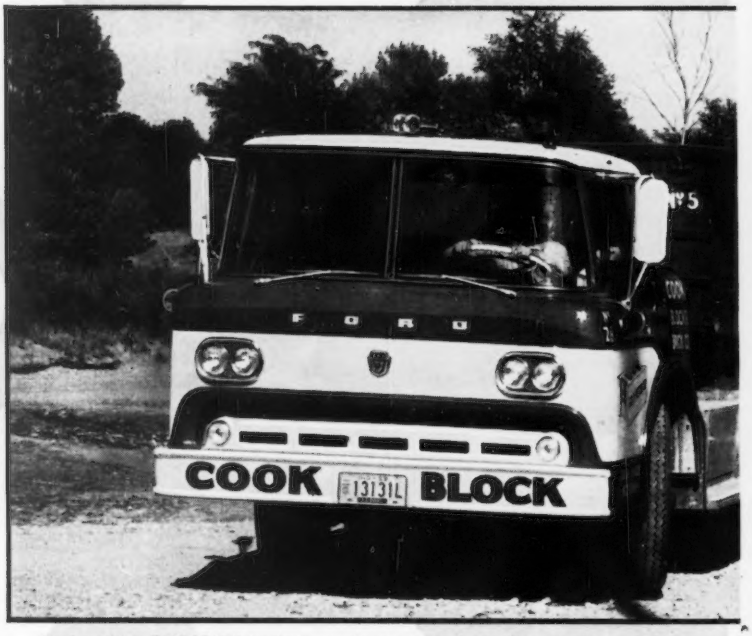
NORTHWEST
ENGINEERING COMPANY
1509 Field Building, 135 South LaSalle Street
Chicago 3, Illinois

Here's another reason why Ford Trucks are your best buy!

"OF ALL THE MAKES WE'VE TRIED FORD TRUCKS GIVE US THE LOWEST MAINTENANCE COST!"

ANOTHER REPEAT BUYER OF FORD TRUCKS

Virgil E. Cook, owner of Cook Block and Brick Co., is convincing proof that there is still plenty of opportunity in American business for those sound planning, hard working individuals who want to own their own business. Starting from scratch just 13 years ago, he now owns and operates one of the largest concrete products plants in Eastern Indiana. The workhorses in his fleet of 16 trucks are three Ford Tilt Cab Tandems that are used to haul sand and gravel to the plant and make deliveries in and around Anderson.



Hard-working Ford CT-950 tractor leaves Cook gravel pit with 18 yards of aggregate. Aluminum walking beam and rubber suspension system of tandem axle assembly reduce chassis weight, permit higher legal payloads.

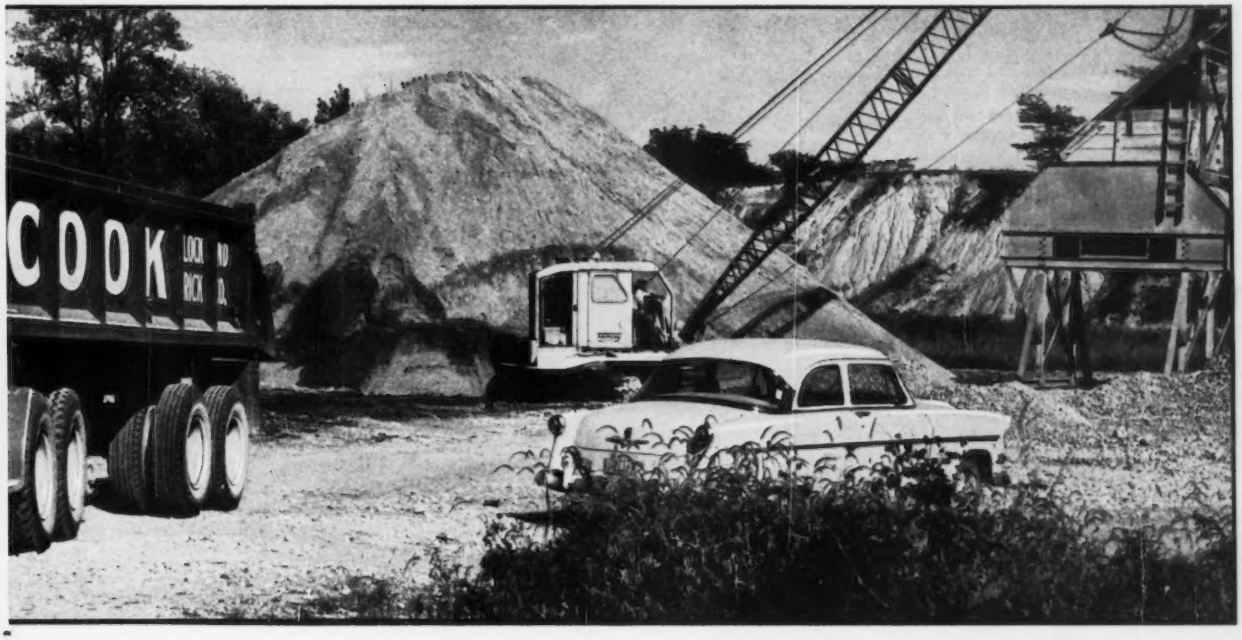
Cook's CT-850 with special flat-bed body and Side-O-Matic unloader delivers blocks right to the job site. Unit carries 600 concrete blocks and spots them where needed.

"Our experience has proved that Ford Trucks can be operated at substantially lower maintenance costs than any other make we've tried. And, equally important in a fleet like ours, we find that our Fords spend much less time in the shop. None of the Ford units purchased since 1958 have been in for major repairs and I am still amazed at the way the older ones keep going.

"The best truck we've ever owned is a 1954 Ford C-700 that consistently carries a load of 350 to 400 blocks over all types of terrain. In spite of this severe work it ran 125,000 miles before we replaced the engine. This unit now has over 140,000 miles on the original ring gear and pinion and it went 60,000 miles before we relined the brakes and put in a new clutch. This is outstanding mileage when you consider that we've realized as little as 12,000 miles from competitive ring gear and pinion sets. Clutch and brake life obtained with other makes in identical service was only 20,000 miles. It's results like this that keep our costs low and convinced us that we should stay with Fords when we bought our bigger trucks in '58.

"Our 1958 and 1959 Ford Tilt Cab Tandems give every indication of equalling or surpassing the fine records set by the C-700. The two CT-950 tractors hauling sand and aggregates to our processing plant breeze through traffic and take the hills like they weren't there at all. Our CT-850 equipped with a flat-bed body has the power and traction to deliver finished products anywhere. With Ford's tilt-cab design we get a real plus as far as payload is concerned because we can carry at least 2,000 pounds more weight on the front axle.

"We buy Ford Tilt Cab Trucks because we think they're the best engineered and most modern gasoline trucks in the heavy-duty field. Here at last is a truck built to permit big legal payloads with enough power to move these loads at economical speeds. We pride ourselves on our modern and efficient equipment and consider our Fords one of the most valuable assets of our business."



'60 Fords are built for longer life . . . with Certified Durability!

Whatever your job . . . wherever you do it . . . you'll discover just as Mr. Cook did, that Ford Trucks are the best investment for your transportation dollar.

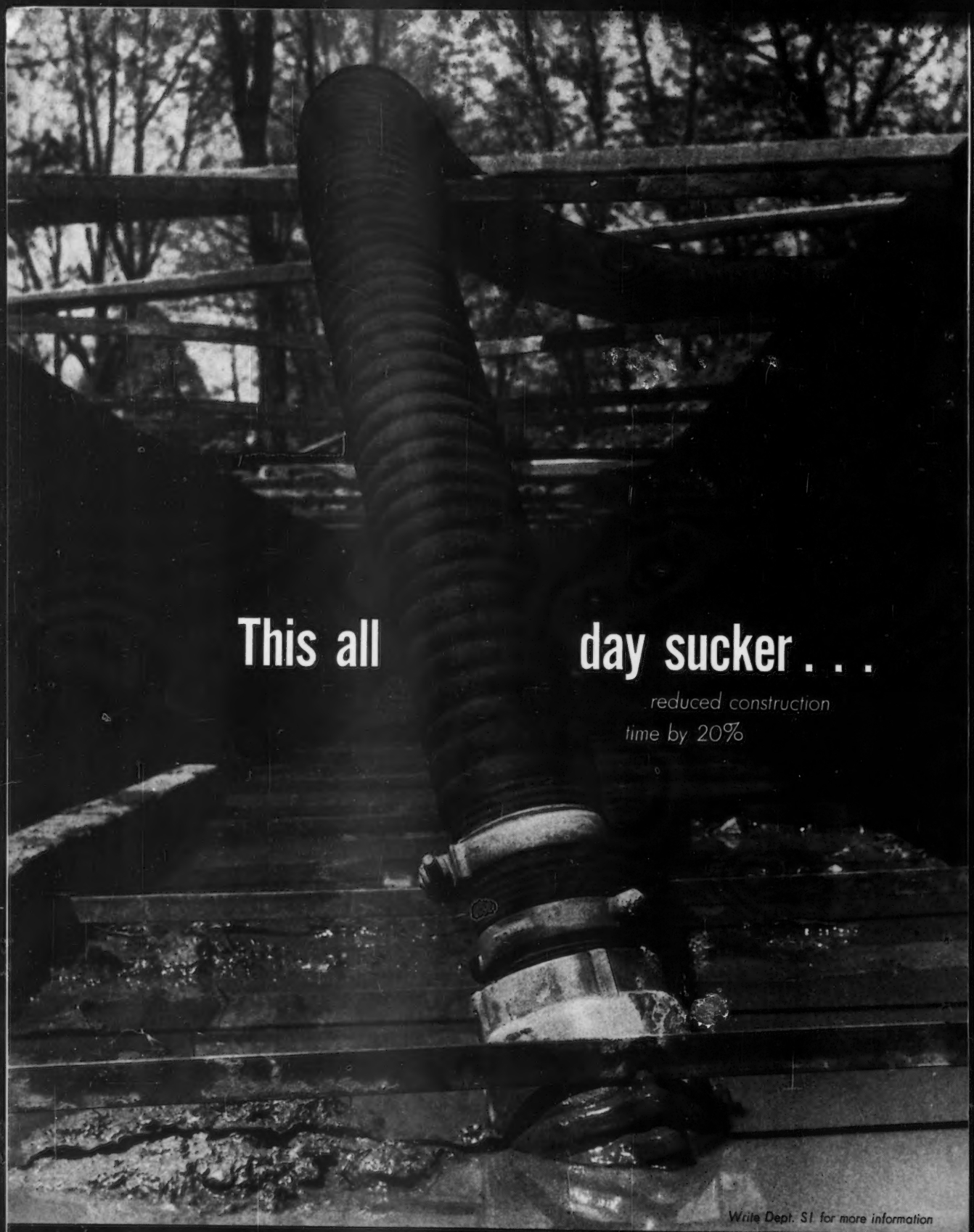
Certified results of tests conducted by America's leading independent research organization (name available on request) confirm the fact that Ford Super Duties have been refined for still more durability! Automatic radiator shutters, improved electric fuel pumps and redesigned wiring harnesses are typical of the advancements to be found in these units.

Automatic radiator shutters reduced the coolant temperature variation recorded in severe mountain road tests from a 79° range to a 20° range. Engine operation with coolant temperatures in the 167° to 187° range means less expansion and contraction, more efficient combustion and better lubrication . . . all of which contribute to longer engine life.

Dynamometer tests showed *no vapor lock* with Ford's submerged-type electric fuel pump at temperatures up to 200°. Incipient vapor lock with mechanical fuel pump resulted in a power loss of 9% under the same conditions. Shaker table tests plus constant exposure to oil, water and heat proved 1960 wiring harness to be *three times longer lived.*

FORD TRUCKS COST LESS

LESS TO OWN . . . LESS TO RUN . . . BUILT TO LAST LONGER, TOO!

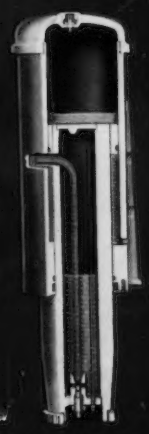


Industrial hose and other rubber products since 1870

Acme Hamilton

MANUFACTURING CORPORATION, TRENTON 3, N. J.

Divisions: Acme Rubber Mfg. Co. • Hamilton Rubber Mfg. Corp.



HYDRAIR*

POWER-TRANSFER DIFFERENTIAL

How these exclusive advantages help you cut hauling costs...

DEEP V-BODY

LW

Haulpak®

These 3 cost-cutting advantages..

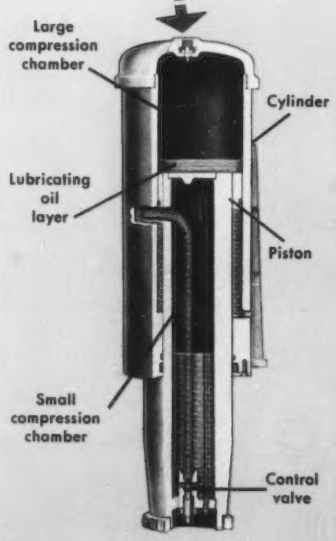
LW HAULPAK
Available in 3 sizes
22, 27 and 32 tons
290, 335 and 375 hp

1 HYDRAIR smooths rough haul roads

On LW Haulpak, you get a sturdy, simple air-hydraulic suspension system that eliminates the costly, time-wasting maintenance and repair of springs. Four Hydrair units cushion against loading and travel shock . . . compensate *automatically* for off-center loading and keep the load riding level over humps and holes.

Other Hydrair benefits:

Located high out of dust, dirt, and moisture, Hydrair cylinders permit higher ground clearance (23″) and sharper turning (Haulpak makes 180° turn in area only 44′6″ wide). The elimination of springs and conventional front axle also reduces non-profitable dead weight.



How this exclusive suspension system works

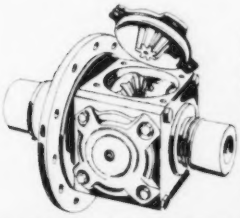
Basically, Hydrair operates like this: The upper compression chamber above the piston supports the load on a cushion of nitrogen gas and the lower compression chamber acts as a rebound chamber to snub the return or downward movement of the piston. The maximum stroke of the piston is 14 inches in the two front suspension units and as much as 7 to 9 inches in the two rear Hydrair units.

Conventional leaf springs have an "action space" of less than 4 inches, so it is easy to judge the tremendous improvement Hydrair represents as far as tire and vehicle life and operator comfort are concerned. Hydrair absorbs and cushions virtually all loading and travel shock, keeping this brutal punishment away from the tires, structure, and operator. Hydrair relieves the pounding on the road surface that creates "washboards".

..yours only in Haulpak

2 POWER-TRANSFER DIFFERENTIAL
pulls load through soft footing

This same exclusive LW differential has boosted production and cut costs for thousands of LW Tournapull® owners for more than 14 years . . . and now, *for the first time,* it is available on a truck. The power-transfer differential *automatically* puts power on the wheel with best traction, so you can haul through soft, slippery spots that bog down conventional haulers. The differential action also reduces wheelspin and tire wear.



The LW Haulpak differential works *automatically* at *all* times, is as simple in construction and as trouble-free as an ordinary differential. When one wheel tends to spin, idler pinions are automatically forced outward against friction surfaces. This slows the slipping wheel, and transfers up to 4 times its tractive effort to wheel on firmer footing. Neither wheel will spin independently until the 4-to-1 ratio is exceeded.

HAULPAK saves you money many other ways:

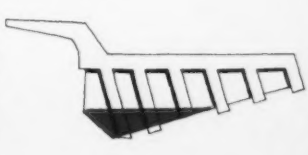
LESS MAINTENANCE (entire lube-check, needed only at 500-hr intervals, consists of just 3 easy-to-reach grease fittings). *POWER-MISER FAN* (cools with 20 to 25 less hp drain). *FOUR SEPARATE BRAKING SYSTEMS* (for fast stops with complete safety). *POSITIVE POWER STEER* (for faster turning, easier handling). *SIMPLE SIX-GEAR FINAL DRIVE* (compared to 12 or more usually standard). *BIG, ROOMY CAB.*

3 DEEP V-BODY gives you bonus tonnage within short wheelbase

Haulpak's exclusive deep V-body allows you to haul extra tons of material within a short wheelbase. Loaded material quickly fills all corners for big, low-void payloads. Deep "V" also provides a low center of gravity . . . gives Haulpak better stability on turns for high-speed hauling no matter how rugged the road.

In addition, the Haulpak V-body is exceptionally strong. It is constructed of high-tensile-strength steel . . . nearly 3 times stronger than steel commonly used in trucks, yet it weighs ⅓ less. Result: *You haul up to 30% more payload than Haulpak's weight.*

Bonus yardage in every Haulpak load rides in the exclusive V-shaped body. Low loading height (10'1") and large top opening (14'5" x 11") makes it easy for shovel operators to load Haulpak fast, without spillage. Heavy rubber pads provide 100% cushioning of the body against loading and travel shock.

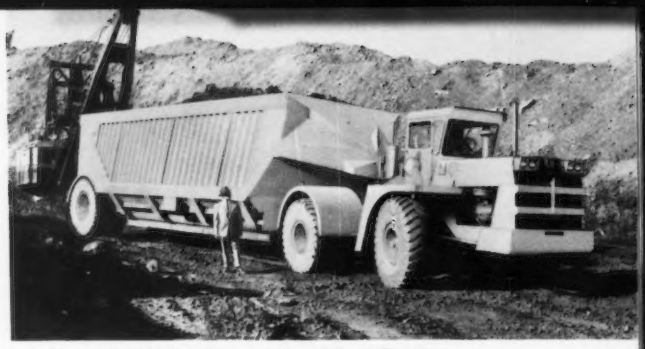


HAULPAK LW 80...

offers new low in hauling costs,

80 tons, 100 yd capacity . . . speeds to 40 mph

Proved in strip mine operations, the 450-hp LW 80 hauls materials at lowest-cost-per-ton. Constructed of light, super-strong steels, Haulpak hauls more than 2 times its weight in payload! It is easier to handle and maneuver than 50-ton units of conventional design. Has many other profitable advantages. *Ask for complete information.*



This 80-ton HAULPAK performs at the Midland Electric Coal Company mine near Farmington, Illinois.

BIGGER PROFITS for you in well maintained haul roads

You can count on fast, low-cost haul-road maintenance when you use powerful heavy-duty LW graders. That's because LW graders work at higher speeds, complete jobs faster. Use them to build and maintain haul roads, level stockpiles and fills, improve drainage. LW graders last longer because of their 100% anti-friction drive and rugged one-piece main-frame. And you'll profit by the big 63-inch blade circle . . . the quick, easy moldboard tilt adjustment . . . rubber engine mounts . . . and full-sweep visibility. Seven models, 67 to 190 horsepower.

See color film "Revolution on Wheels"

In this 15-minute film you will see Haulpaks at work on highway construction, in copper and iron mines, and in rock quarries. You'll see why and how Haulpak moves more tonnage at big savings. Your LW Distributor will be happy to show you this film, "Revolution on Wheels".

Get complete facts on LeTourneau-Westinghouse equipment from your LW Distributor

Your nearby LW Distributor is ready, willing, and completely able to help you solve your hauling problems. He also handles LeTourneau-Westinghouse earthmoving equipment—Tournapulls, rubber-tired tractors, Rear-Dumps—and other lines of proven production tools. He is in a position to give you honest appraisal of trade-in equipment, and can assist you in obtaining helpful financing when it is needed.

See your Distributor, too, for dependable repair service and LW factory parts. You will be pleased with his prompt and efficient attention to your needs. Ask him to check your parts stock, and help arrange a schedule so his service department and yours can work together with greatest efficiency. You'll find your LW Distributor a good man to know. See him soon.

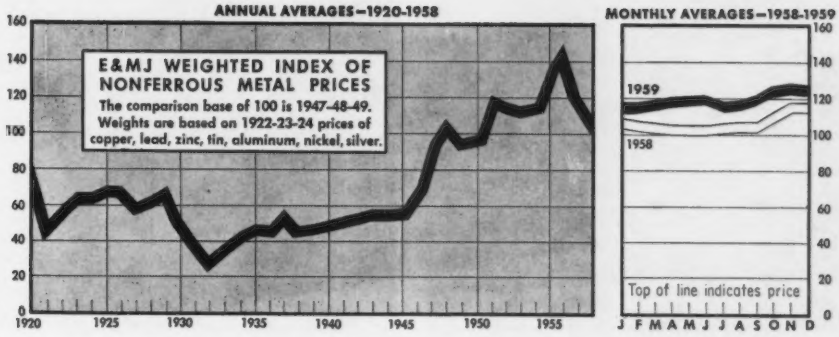
Litho in U.S.A.

L-TOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILL.

HP-2265-G-4

E&MJ OUTLOOK

PRICES



MARKETS

Lower prices for copper, lead and tin, which were only partially offset by a 0.5c increase in aluminum, dropped E&MJ's nonferrous metals price index from 129.5 for November to 128.1 for December.

●

AT HOME

U.S. automobile output, major outlet for metals, totaled approximately 5.6-million cars for 1959. McGraw-Hill Department of Economics estimates that 1960 sales will be 6.8-million units, plus 450,000 imports, establishing a record sales total of 7.25-million cars for 1960.

McGraw-Hill's preliminary survey of business' plans, taken in October 1959, indicates that capital spending plans by all business in the U.S. will total $37.3-billion, $3.4-billion over 1959 expenditures.

Lockheed Aircraft Corp. has a research contract to study a fuel cell which will harness solar energy. It is believed that an efficient unit can be devised which will use solar energy to regenerate the current-producing reactants required to operate a fuel cell.

Interest runs high in a new alloy called "T-metal" announced by Hydrometals, Inc., in November. It has been predicted that the new metal containing zinc, titanium and copper, will be competitive with stainless steel, aluminum, galvanized iron and copper and brass in many applications. Fred M. Zeder II, president of Hydrometals, said the 1960 sales objective is 32-million lb.

Union Carbide Metals Co.'s shipments of pure vanadium metals in 1959 were more than seven times the shipments made by the company in 1958. A substantial increase in the purity of the metal accounted for much of the increase.

American Zinc Institute has virtually doubled its budget for research and development during the past two years. An outstanding accomplishment of the program has been recently announced plating techniques for zinc die casting to assure dramatically increased blemish-free service life for die-cast auto bright-work.

●

LABOR

International Union of Mine, Mill and Smelter Workers has thrown its support to defense lawyers in plans to appeal the Federal court conviction Dec. 18 of nine present and former leaders who were convicted of conspiring to defraud the Government by filing non-Communist affidavits with the National Labor Relations Board while continuing Communist Party activities.

●

ABROAD

Discovery of a significant copper-bearing deposit at the famous MacIntyre Porcupine Mines property in Ontario has sharpened interest in this old gold producer. NORTHERN MINER reports that drill holes on two levels have indicated a length of 800 ft, open at both ends, grading 1.3% copper and 0.02 oz gold across a width of more than 30 ft.

The Soviet Union is employing about 40,000 geologists, about twice as many as are active in government, industry and educational institutions in the U.S., according to a Senate Interior Committee report.

Litho in U.S.A. L-TOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILL. HP-2265-G-4

THIS MONTH IN MINING

MORE THAN 900 members and guests signed up for the 65th annual meeting of the Northwest Mining Association.

LUNCHEONS, like general sessions, combined top authorities in operating technology and leaders in industry opinion.

NWMA Sums Up Industry Today: Cites Needs

SEVERAL SIGNIFICANT CHANGES in U. S. mineral policies were urged at the 65th annual convention of the Northwest Mining association in Spokane Dec. 4 and 5.

These included proposals for the use of import taxes instead of quotas to control mineral imports, changes in the government's gold and silver policies and a series of changes in the present tax structure to provide deduction for mining exploration expenditures and reduction of individual and corporation taxes. Also urged by the group was additional labor reform legislation.

Lead-off speaker at the opening session was Wallace G. Woolf, vice president in charge of Kellogg operations for Bunker Hill Co. He read a paper which had been prepared by the late John D. Bradley, Bunker Hill president who was killed in an automobile accident in San Francisco on Thanksgiving day.

Woolf, praising Bradley's leadership with the northern Idaho mining and smelting firm, said Bunker Hill is studying the fields of high temperature metals, titanium pigments and industrial phosphate chemicals for possible further diversification of the lead-zinc producing firm.

He disclosed plans by the company to market its own zinc oxides on the Pacific Coast and described progress on a venture with Sherwin-Williams Paint Co. on a newly constructed barium monohydrate plant.

The head of British Columbia's largest gold producing firm, Franc R. Joubin, president of Bralorne Pioneer Mines and a discoverer of uranium properties in Canada's Blind river district, predicted an increase in the U. S. price of gold sometime after the 1960 presidential election. Gold mining, he added, is becoming more attractive.

A prediction that the U.S. Tariff Commission will reject a petition to rescind import quotas was made by C. E. Schwab, recent chairman of the Emergency Lead-Zinc Committee who became the general manager of the Bunker Hill Co. on Jan. 1, 1960. The petition was offered by six importing smelter firms.

Schwab outlined the purpose of the Tariff Commission hearings slated in January on what additional import restrictions are needed to help the domestic lead-zinc mining industry. He said that depressed conditions in lead-zinc mining are the motivation behind the commission's forthcoming review — not the problems of importing smelters, which he said now cannot get all the concentrate imports they want.

Power costs for the aluminum industry in the Northwest have remained constant while other costs, principally freight rates, have increased to the point that Northwest aluminum plants are in competition with eastern locations, the manager of Northwest operations for Kaiser Aluminum and Chemical Corp. told the convention. Norman L. Krey said that aluminum producers in the Northwest have always had the disadvantage of high freight rates, but he said that favorable electric power rates served as an offset until recently.

He urged a four-point program to stimulate production of aluminum and other metals in the Northwest:

1. Recognize that the adverse competitive position of Northwest-produced aluminum requires assurance of a continuous, long-term supply of power at a price which considers competitive factors.
2. Encourage continued development and operating efficiency of transportation systems and facilities to assure the lowest possible freight costs in order to meet the competitive challenge from other regions.
3. Insist upon law-making and administration which reflects understanding of industry problems in order to create and maintain a favorable business climate.
4. Capitalize upon the location advantage of Northwest aluminum in serving the western market by concentrating industrial development efforts to expand and attract aluminum product manufacture.

Anaconda Co.'s vast operations in the Butte, Mont., district were outlined by Andrew R. Sims, general superintendent of mines. Block caving and open pit mining have become increasingly important in Anaconda's Butte operations, he said. In the first six months of 1959 open pit accounted for 63.31% of total production, block caving 26.88% and stope mining only 9.81%.

Average daily production was 4,896 tons from stope mines, 12,890 tons from block caving and 29,006 tons from open pit. Even more significant is the comparison on a man-shift basis. Sims said stope mines accounted for an average of 3.428 tons per man shift at a cost of $11.44 per ton. With block caving it was 26.3 tons per man shift with a cost of $1.627 per ton. Open pit operations produced 86.9 tons per man shift at an average per ton cost of .686¢.

However, he added that stoping, despite its higher cost and lower efficiency per ton produced, will always have its place in Butte and other mining districts where fissure veins exist.

Tracing the history of copper mining operations in the Butte area, he said to date nearly 300-million tons of ore have been mined with the recovery of nearly 15-billion lb of copper up to July 1, 1959, In addition to the copper, the operations have produced more than 28-million tons of zinc ore with recovery of 4.5-billion lb of zinc and 8-million tons of manganese ore which yielded more than 3.5-billion lb of manganese. Also recovered have been 618-million oz of silver and 2.3-million oz of gold.

Sims presented a paper prepared by E. I. Renouard, vice president in charge of the company's western operations,

who was unable to attend because of other business. Sims spoke at a Dec. 4, luncheon session sponsored by the mining bureau of the Spokane Chamber of Commerce.

An "Economics of Metals" session Dec. 4 featured talks by Clark L. Wilson, vice president of New Park Mining Co. and Silver Buckle Mining Co., Salt Lake City; L. L. Huelsdonk, secretary-treasurer and general manager of Best Mines Co., Inc., Downieville, Calif.; Schwab, and Krey. Co-chairmen of the session were J. C. Kieffer, manager of Northwest operations for American Smelting and Refining Co., Wallace, Idaho, and E. H. Lovitt, president of Lovitt Mining Co., Wenatchee, Wash.

Wilson described silver as "the metal with the future" and predicted a higher price for the metal as uses of it are expanded.

"I believe that with some logical and justified adjustment in Treasury policy," he said, "the other factors affecting the metal are such that silver will soon become of prime importance to the optimistic miner and investor."

Silver uses, he added, are becoming more diversified. He cited the growing industrial uses of the metal.

He urged that the government eliminate seigniorage to provide price that will encourage production of additional needed silver and at the same time eliminate a special sales price to selected buyers. He said that the present sales of "free silver" artificially affect the world market price, penalizing the miner and jeopardizing a much needed silver supply. This practice, he concluded, should stop.

A report on the Consolidated Mining and Smelting Company of Canada, Ltd., iron and steel project in British Columbia was one of the highlights of a "New Developments" session Dec. 5. T. R. Stanley, of the Cominco staff, indicated that the project was undertaken after some 10 years of studies. The new operation at Kimberly, B. C., followed pilot plant tests carried out by the company's research and development division in 1949 and 1950.

He said the company's interest in the project stems from the fact that iron is the major metalliferrous component of ore from the Sullivan mining property, comprising about 25% of the ore mined.

"All of the iron is not economically recoverable but at current mining levels about 1600 tons of recoverable iron is produced per operating day," he said. "This compares with about 450 tons each of lead and zinc."

According to Stanley, the company's extensive testing program, which included some 200 sintering tests, provided the necessary information to prepare required plant layouts and economic data for the production of pig iron from Cominco's concentrates.

He said site and foundation work at

(*This Month continues p 106*)

As We Went to Press . . .

Cuban Prime Minister Fidel Castro has interjected a new proposal into the running negotiations now going on between U.S. mining interests and the Cuban government. As an alternative to the 25% export tax on all minerals suggested by Castro recently (E&MJ, December, p 20) Castro has suggested that foreign owned mines in Cuba agree instead to a plan which would make the government a commissioned sales agent for their output.

Under the new plan, Freeport Nickel Co. (December, p 84) and General Services Administration would sell the nickel-cobalt ores they produce at Moa Bay and Nicaro, respectively, through Havana. The government would collect normal commercial dollar payments for the output, then return 95% of the sales price (in Cuban pesos) to the owners. Freeport and GSA would then not be subject to the 25% minerals export tax.

Freeport and GSA are studying the new plan; but as yet they are uncertain whether it is a sincere compromise effort on Castro's part to find a way for foreign investment to co-exist under his plan of rapid nationalization of Cuban industry, or whether it is a step in the direction of a total takeover of all foreign productive capacity on the island.

The U.S. imbalance-of-payments is beginning to correct itself, Commerce Department reports, on the basis of third-quarter 1959 returns. Metal and mineral exports are up more than most other U.S. sales abroad, the analysis shows. Imports continue to rise, but exports are going up at a faster rate.

In the next decade, Cleveland-Cliffs Iron Co. will increase production of iron ore to 16-million gross tons per year from the current 9-million tons. H. Stuart Harrison, executive vice president of the firm, said that the increase would come from low grade domestic deposits and from foreign sources, principally in Canada and Brazil.

Sinking 1,000 ft per month, "the four-minute mile" of the South African mining industry, was accomplished Dec. 1 at President Steyn gold mine, right behind its competitor, Vaal Reefs, of Traansvaal, which took the world's record in September with a figure of 922 ft. (E&MJ, November, p 128)

Like Vaal Reefs, the President Steyn is a circular shaft, about 28 ft in diameter.

Two mergers received approval—the Lucky Mc and Utah Construction and Mining Co. proposal got board of directors okays, pending stockholder approval Jan. 29, and Yuba Consolidated and White Canyon Mining found the majority of its stockholders in agreement to a marriage (p 115).

Work has begun on a $2.1-million copper refinery at the Alaska mine in Southern Rhodesia. Messina Rhodesia Smelting and Refining Co. is the proprietor.

WASHINGTON IMPACT

Highlights

1960: A YEAR OF TRIAL—Last year's business upturn, in which many segments of U.S. metal-mineral industries shared, did no more than anticipated toward resolving mining policy in Washington. Broadly, 1959 was a year of Congressional and Administration holding actions. This year, as in 1958, some of the continuing issues again will come to a head. Three stand out:

TRADE—for U.S. foreign trade policy in general, the annual reciprocal trade agreement negotiations under the General Agreement on Tariffs and Trade (GATT) at Geneva next Fall will be the most significant in several years. That is the point at which Washington will bargain with the new European economic groups—the Common Market and the Free Trade Association.

Much tariff-setting groundwork already has been laid, more will be done between now and then. The Administration's goal, shared by many Democrats, is to keep overall trade policy as liberal as possible in order to pave the way for U.S. exports. It is by freer trade, rather than by more restrictions on imports, that the Administration hopes to correct its imbalance of international payments.

But within this framework, domestic mining interests will sharpen their drive for increased protection. To an unknown degree, they will be aided by the traditionally protective climate of an election year.

For domestic mines, the key test is not next Fall's GATT sessions, but a new approach to legislated rather than Administered protection. The current tariff commission studies of lead-zinc and fluorspar (see story this page) will wind up with a reporting of the agency's "findings of fact" to Congress instead of to the White House.

The key point in this maneuver is that the domestic producers are betting they stand a better chance of winning new trade protection from Congress than from the President. This of course is a frank gamble—Congress has not legislated a direct tariff or quota on its own initiative in nearly 30 years. But should the Congressional mining bloc succeed in passing a tariff or quota over Administration opposition, this device would quickly be picked up by other domestic seekers of trade protection.

STOCKPILE DISPOSAL—As an issue, the question now facing Washington on stockpiling is one of selling strategic minerals rather than buying them. Office of Civil and Defense Mobilization wants broader Congressional authority than it presently has to dispose of surplus stocks it considers in excess of defense requirement.

Two skirmishes in this running battle will be fought out this year. One is the current series of informal negotiations between the Administration and Congressional staffers over whether or not to release copper stocks, and if so, when, how much, and how. The other is OCDM director Leo Hoegh's announced intention to present Congress with an Administration legislative request for authority to set up a new materials reserve inventory from which OCDM could release supplies it considers surplus without specific Congressional approval now required for most stocks (see story this page).

COMMODITY STABILIZATION—A longer-range fight over international commodity stabilization agreements also faces a possible showdown this year. Traditionally opposed to such pacts, the Administration is now taking a more willing attitude at least toward exploring their potential.

This switch is part of Washington's concern over political and economic relations with Latin America and other less-developed commodity producing areas. The International Tin Agreement comes up for extension in the United Nations next spring, and the Administration is continuing to participate in U.N.-sponsored talks on lead and zinc—although the White House last month assured House Interior committee chairman Wayne Aspinall (D-Colo.) it will not remove existing lead-zinc import quotas until distressed domestic mines show substantial improvement.

Tariff Influence Moves Toward the Congress

THE FOCAL POINT of Washington's most significant metal-mineral policy issues in the year ahead centers on the lead and zinc industries. Domestic producers are in the middle of both tariff and commodity stabilization battles (see Highlights, this page).

At the Tariff Commission, it is a broad investigation of domestic mines' state of health that will test a new maneuver toward giving Congress, rather than the White House, a larger say in setting tariff and quota rates. The lead-zinc case gets underway this month, with hearings scheduled for Jan. 12. The Commission is expected to report its lead-zinc conclusions first, probably by March.

Lead-zinc and fluorspar studies were ordered last summer by Congress under Section #322 of the Tariff Commission Act. Traditionally, this has been interpreted as an academic sort of authorization for the Commission to collect import and other economic statistics, but reach no conclusion or recommendation on what change if any should be made in existing import controls.

The new Section #332 probes, however, were directed by the Senate Finance Committee and passed by the Senate over Administration objections with clear instructions to the Commission to report back "specific findings of fact" as to what, if any, change in existing lead-zinc import quotas and fluorspar tariffs should be made to protect a healthy domestic industry.

More normally, the Commission's specific recommendations come under escape clause and peril point investigations, and are reported to the President, under the delegatory powers of the Reciprocal Trade Agreements Act.

A Commission report finding that existing import quotas on lead-zinc should be broadened to cover manufactured and semi-finished products as well as ores and concentrates, would pave the way for the Congressional mining bloc to push legislation to accomplish that goal.

Congress has not directly legislated a tariff on its own initiative in almost 30 years, and any attempt to do so would be strongly opposed by the White House. Nevertheless, domestic lead-zinc producers are gambling they stand a better chance at new trade protection through this route than through the escape clause and peril point procedures.

In fact, an escape clause petition filed by six leading domestic lead-zinc smelters who oppose existing quotas was rejected by the Commission last month after Western mining-state Senators telegraphed the Commission that such a move would be a "divisive and diversionary affront to Congress."

Domestic producers are shooting for several goals. The minimum is retention of present quotas, which they fear may be removed by the White House if foreign political pressures from importing countries get too strong.

In this aim, the domestic mines got some reassurance last month, when White House economic adviser Don Paarlberg wrote House Interior chairman Wayne Aspinall that the quotas would stay in effect "until distressed segments of the domestic industry show substantial improvement."

Aspinall had written President Eisenhower to complain that an official joint communique issued after Mexican president Lopez-Mateos' visit last Fall hinted import restrictions might be eased.

Beyond that, domestic producers want a Commission finding that quotas should be tightened, or extended to products as well as ores and concentrates, or both. One possibility is that the Commission may recommend prohibitive ad valorem tariffs to be charged on all lead-zinc imports above a set quota level. This is the approach the Commission took in a recent escape clause case involving stainless steel flatware, and the White House adopted the Commission's recommendations.

Still further, domestic producers hope the Commission study will counteract the political pressures foreign lead-zinc interests will bring on Washington to ease restrictions at a fourth United Nations lead-zinc conference tentatively scheduled for this month or next. This conference, like its predecessors, is not likely to result in agreement on mandatory international production or export controls.

Copper Disposal Moves Await Procedure Ruling

COPPER IS THE KEY to the other major mining policy fight, over stockpile disposal. Informal talks between OCDM officials and Congressional mining committee staffers have once again failed to reach agreement. This time, the breakdown came not over how much copper should be released (up to 125,000-tons) or when (after the strike settlement), but over how the disposal should be handled.

Government officials, responding to pressures from smelters and refiners, want disposal handled through Commerce Department's Business and Defense Services Administration, which is charged with the Government's defense materials allocations and priorities program. Capitol Hill staffers, reflecting industry views, want disposal handled by major producers in the industry itself, on a non-profit basis. At this point, neither side will accede to the other's wishes, so no disposal is in sight.

Labor This Month

BIG UNION SETTLEMENTS REVERSE FIELD: When the 1959 copper wage contracts began lining up, they completed a new pattern in major industrial negotiations. Until this year, aluminum, can, nonferrous mining and other top industrial bargaining waited out agreements in the basic steel industry. Through most of the long steel dispute, the copper strike lingered while the United Steelworkers talked with the steel industry. The change came with the break-through of the Kaiser Steel Co. settlement. This 22c 20-month contract became the union target and, while Big Steel wouldn't go along, it set the pattern for other industries.

SPLITTING THE DIFFERENCE: If you look back to the start of nonferrous bargaining more than six months ago, the final terms of the agreements with Mine-Mill are modest. While basic steel rejected the Kaiser-type package, its wage pattern was far below the original demands of the unions. The fight-inflation stand of the steel companies kept wage hikes down at a time of rising prosperity. But, without the heated contest over working rules, industry costs might have been lighter in the end.

Here's the breakdown of the Kennecott agreement with Mine-Mill:

- A 22.3c contract covering 18½ months.
- Two wage increases, payable last mid-December and on July 1, 1960, ranging from 7 to 10.6c an hour. A restudy of job classifications is expected to bring additional hourly increases for certain employees.
- An added holiday in 1960 and 1961 and extra health and welfare benefits averaging one-half cent per worker.

THE BARGAINING OUTLOOK—1960: The new settlements just about complete the picture for this year—and it looks like a tough one. Some critical bargaining sessions—following in the wake of steel—are already heating up, though the final showdown is mid-1960, or later.

Trouble spots are these: industry-wide railroad negotiations, almost sure to go to the end of the line without settlement. Look for a May 1 strike target date by the unions. Shortly thereafter, five unions—led by the International Union of Electrical Workers—start contract talks with General Electric and Westinghouse. Their five-year agreements terminate in October. Aircraft deadlines in April, shipbuilding in June and communication negotiations throughout the last part of 1960 complete the big bargaining picture.

MEN VS MACHINES—A WAY OUT: Automation, and its threat on workers' jobs was at the heart of 1959 labor-management disputes. It centers in the key 1960 bargaining contests. Now, a drive is on to find solutions to job upheavals caused by the steady advance of technology.

These are the plans, so far, to face up to automation:

- Early this spring, the White House hopes to promote a top-level labor-management get-reacquainted conference. No bargaining talk, but a discussion, between heads of industry and labor, on matters of mutual interest. The first concern; to devise an agenda that will keep the parties talking around the table. Previous conferences of this sort have fluffed badly.
- The Kaiser Steel agreement has a key clause, designed to find the solution to constant steel strikes. It sets up a committee of three top mediators—David L. Cole and George W. Taylor, both former Federal mediation chiefs and John T. Dunlop—top arbitrator in the construction industry—to find the key to "sharing the progress" in the steel industry between the companies, workers and public.
- In the new meat packing labor agreements, the industry is providing $500,000 for a survey of automation in the industry and how to minimize its impact on union members. Another top mediator, Clark Kerr, chancellor of the University of California, heads this survey.

Lead Down 1c; Aluminum Prices Up; Some Copper Strikes Continue

NONFERROUS METAL PRICES in December dropped to 128.4% of the 1947-49 average from 129.5 in November, the E&MJ index of nonferrous metal prices shows. The drop in lead prices and the slight fall in copper brought the index down; tin was also off slightly. The rise in aluminum offset the above somewhat.

Some copper strikes remained unsettled in the U.S. All of the Kennecott properties were working except the Utah mines and mill. The Utah smelter and refinery were operating on materials that were available when the strike started. Kennecott expects to be shipping increased amounts of metal. Some craft unions at the Kennecott Utah properties have not settled. All Asarco copper properties are back in operation. Phelps Dodge at the end of the year had not settled its strikes.

Copper Institute statistics for November showed free world refined stocks down 19,937 tons but blister stocks rose 16,301 short tons. Refined stocks were 310,501 tons; they dropped about 70,000 tons since the strike began in July. Stocks held by sellers in the U.S. have dropped little partly because the U.S. producers' policy has been to keep low stocks.

Fabricators' stocks of copper in the U.S., including copper in process of fabrication and in products, dropped in November to 412,401 tons from 431,612.

Copper prices reflected changes in the outlook for the strikes. Some unions settled in November and prices in London dropped. But as strikes by others continued and appeared unlikely of settlement prices firmed. Late in the month trouble developed in Mufulira which pushed the London Metal Exchange prompt bid price to £262, about 32¾c a lb. With this trouble over London rapidly lost some of its strength.

Merchant prices in the U.S. followed along with the LME and the N.Y. Commodity Exchange.

The 1960 copper outlook was for rather heavy consumption—over 1959—but when strikes are settled output will probably be heavy. Some suggest it will be so heavy that prices, including both custom smelter and producer prices, will ease.

Aluminum prices were boosted by U.S. and Canadian primary producers. The price increase had been expected but the form it took was surprising. Aluminium Ltd. announced December 16 that it was pttting ingot prices up ¾c a lb to 23.25c for all markets outside the U.S. The U.S. producers, which had been talking for months about the necessity of a price increase, took this as their signal. Alcoa led off with a price hike effective Dec. 17 of 1.3c a lb for pig and ingot for sale in the U.S. This brought the pig price up to 26c delivered. It also went to 23¼c for foreign markets. Other U.S. producers followed these increases but the smaller ones waited several days. Mill product prices were also raised.

The 26c price is now equal to the price of two years ago. Aluminium Ltd. had dropped it then to 24c and last year following the annual wage increase U.S. producers had added 0.7c.

Probably the price rise was needed more in mill products than in pig and ingot. In the production of pig and ingot labor costs are small—most estimates are about 2½c a lb. Wage rates have been about $3 per hour. A 15c per hour raise is about 5%. This would raise pig costs about 0.125c a lb. The situation is different in mill products where labor costs are a much higher proportion of total costs.

The new prices raise the spread between what the U.S. fabricator pays and what his foreign competitor pays. This should make the import of mill products from outside the U.S. easier. In 1959 mill product imports more than doubled. With the wider price spread for pig and other aluminum products and the easier access to the major U.S. market for mill products—the mid-West—through the St. Lawrence Seaway, the U.S. fabricator may find foreign competition a much more im- that it was putting ingot prices up ¾c producer, also, but much less than the independent fabricator.

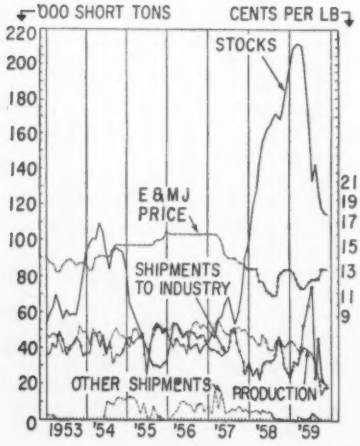
Some pig sellers in the U.S. expressed concern over "leakage" of pig from the 23¼c areas into the U.S. 26c area.

Lead prices tumbled down in December. Many had felt the market conditions and the lead outlook did not furnish much support for the 13c New York price. Foreign lead was being sold in the U.S. at least one cent under. In spite of the strikes at smelters producing about half the U.S. lead, stocks were very high. Buyers of concentrates felt if they continued to buy at a price based on the 13c metal price they would build an inventory which they might have to sell at a lower price. On December 14 a major custom smelter dropped lead to 12½c N.Y. and a week later it dropped it to 12c; other sellers followed.

The lower price brought a few more buyers into the market—most had expected the price to fall. Sales in November as well as October and September had been very low—most buyers had stocked up. The last two weeks of December sales were better but the total for the month was still low.

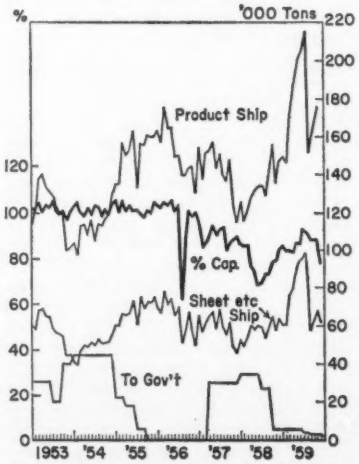
Zinc markets were firm in December and many expect them to become even firmer. The Prime Western price held at 12½c a lb East. St. Louis. Zinc in London varied from £93¼ to £97 in December (11⅝c to 12⅛c a lb). In the past few months the relatively high prices outside the U.S. have caused significant amounts of metal, mainly Special High Grade, refined in the U.S. from foreign concentrates, to be exported. In 1960 zinc markets are likely to remain firm owing to the good outlook for autos and appliances and to galvanized steel.

Primary Refined Lead Data



Data, except price, from the American Bureau of Metal Statistics. "Other Shipments" refers to shipments to the U.S. Government. The price is the *E&MJ* weighted average N.Y. Data through Nov.

U.S. Aluminum



The heavy line and the left hand scale show the % of primary capacity at which the industry is operating. Product shipments (Census Bureau data) are the total tonnage of aluminum fabricated products and castings shipped—these products are made from primary, secondary and imported metal. "Sheet etc. shipments" are Aluminum Association data for sheet and foil for regularly reporting companies. All data through November except product shipments through October.

Average Prices December *(E&MJ Quotations)*

Cents per lb unless otherwise indicated:

Copper:	
Electro, domestic refinery	33.724
Electrolytic, export refinery	30.801
Electrolytic, c.i.f. Cont'l ports	31.746
Lead.	
Common, New York	12.523
Common, St. Louis	12.323
Silver:	
Silver, New York, per oz	91.375
Silver, London, pence per oz	80.250
Zinc:	
Prime, Western, East St. Louis	12.500
Prime, Western, delivered (g	13.000
Tin:	
New York Straits	99.153
Gold, per oz, U.S. price	$35.000
Sterling, Exchange	279.845
Quicksilver, per flask	214.091
Antimony, (E&MJ) (d)	32.590
Antimony, bulk, Laredo	29.000
Antimony, in cases, Laredo	29.500
Antimony for 99½%	24.500
Platinum, refined, per oz	$77.000
Cadmium (a)	130.000
Cadmium (b)	140.000
Al, 99½% dom., ingot	27.255
export, pig	22.841
Magnesium, ingot	35.250
Nickel (f)	74.000
Bismuth	$2.250
Cobalt	$1.750

Domestic quotations, unless otherwise stated are in cents per lb. Sterling exchange checks, in cents. Quicksilver per flask of 76 lb.
(a) Per lb delivered, ton lots.
(b) Per lb delivered, small lots.
(d) Domestic 5 tons or more but less than carload lots, packed in case f.o.b New York.
(f) Contract price, f.o.b. Port Colborne U.S. duty included.
(g) Delivered where freight exceeds 0.5c.

Custom Smelter Copper

Based on flat price and E&MJ average prices sales in U.S. for month of December reported by American Smelting & Refining Co. electrolytic copper in standard shapes, adjusted to nearest ⅛c; ¼c deducted for selling common.

Delivered consumer's plant	34.500 lb
F. o. b. refinery	34.100 lb

Free Gold Market

Total international gold dealings declined 12¼% during 1959. Total sales amounted to $1¾-billion. Bar prices eased fractionally with decreases of about 14% in a few Asiatic centers. Coin prices also showed minor losses in European markets with sharp declines in Bombay and Djakarta where prices reached six-year lows. The gold outflow from the United States continued, totaling $1½-billion for 1959. Soviet sales during the year were estimated at about $240- to $260-million, an increase over last year's Russian offerings. PICK'S WORLD CURRENCY REPORT quotes on "free gold" per fine oz as follows:

	Coins		Bars (12.5 kg)	
	Nov. 30	Dec. 31	Nov. 30	Dec. 31
New York transit	.....	.....	$35.08⅛	$35.08⅛
Manila	$40.50	$40.25	35.80	35.80
Hong Kong	46.20	47.10	38.50	38.60
Bombay	52.00	49.00	51.75	48.75
Tangier	38.10	38.50	35.15	35.10
Beirut	40.50	39.80	35.18½	35.18½
Paris	40.25	39.90	35.70	35.55
Buenos Aires	38.75	40.00	35.90	35.80

Note: Prices are quoted at the free or black market value of the U. S. dollar in the local markets.

Major Metals

U.S. DAILY AND AVERAGE PRICES

Cents per lb unless otherwise indicated:

Dec. 1959	Electrolytic Copper (a) Domestic	(b) Export	Europe c.i.f. (c)	Lead New York	Lead St. Louis	Zinc (f) Delivered	Zinc East St. Louis	Aluminum Primary Pig 99% U. S. Dest.	Straits Tin New York
1	33.450	29.300	30.245	13.000	12.800	13.000	12.500	24.700	99.500
2	33.475	29.650	30.595	13.000	12.800	13.000	12.500	24.700	99.625
3	33.525	29.525	30.470	13.000	12.800	13.000	12.500	24.700	99.500
4	33.100	30.100	31.045	13.000	12.800	13.000	12.500	24.700	99.625
7	33.300	30.850	31.795	13.000	12.800	13.000	12.500	24.700	99.125
8	33.425	30.775	31.720	13.000	12.800	13.000	12.500	24.700	99.500
9	33.375	31.250	32.195	13.000	12.800	13.000	12.500	24.700	100.000
10	33.725	30.600	31.545	13.000	12.800	13.000	12.500	24.700	99.500
11	33.800	30.925	31.870	13.000	12.800	13.000	12.500	24.700	99.250
14	34.025	31.000	31.945	12.500	12.300	13.000	12.500	24.700	99.000
15	34.000	30.700	31.645	12.500	12.300	13.000	12.500	24.700	98.750
16	34.575	30.875	31.820	12.500	12.300	13.000	12.500	24.700	98.875
17	33.600	30.425	31.370	12.500	12.300	13.000	12.500	25.000	99.125
18	33.825	30.650	31.595	12.500	12.300	13.000	12.500	25.300	99.125
21	33.775	30.650	31.595	12.000	11.800	13.000	12.500	25.400	99.125
22	33.875	31.325	32.270	12.000	11.800	13.000	12.500	25.400	99.125
23	33.925	31.475	32.420	12.000	11.800	13.000	12.500	25.900	99.000
24	34.175	31.550	32.495	12.000	11.800	13.000	12.500	26.000	98.875
25	Holiday								
28	33.950	31.475	32.420	12.000	11.800	13.000	12.500	26.000	98.625
29	33.675	31.775	32.720	12.000	11.800	13.000	12.500	26.000	98.500
30	34.150	31.525	32.470	12.000	11.800	13.000	12.500	26.000	98.750
31	33.200	31.225	32.170	12.000	11.800	13.000	12.500	26.000	98.875
AVERAGES FOR MONTH									
Dec.	33.724	30.801	31.746	12.523	12.323	13.000	12.500	25.155	99.153
AVERAGES FOR WEEK									
Dec.									
2	33.344	29.215	30.160	13.000	12.800	13.000	12.500	24.700	100.000
9	33.345	30.500	31.445	13.000	12.800	13.000	12.500	24.700	99.550
16	34.025	30.820	31.765	12.700	12.500	13.000	12.500	24.700	99.075
23	33.800	30.905	31.850	12.200	12.000	13.000	12.500	25.400	99.100
30	33.988	31.581	32.526	12.000	11.800	13.000	12.500	26.000	98.688
CALENDAR WEEK AVERAGES									
Dec.									
4	33.355	29.520	30.465	13.000	12.800	13.000	12.500	24.700	99.700
11	33.525	30.880	31.825	13.000	12.800	13.000	12.500	24.700	99.475
18	34.005	30.730	31.675	12.500	12.300	13.000	12.500	24.880	98.975
25	33.938	31.250	32.195	12.000	11.800	13.000	12.500	25.675	99.031
31	33.744	31.500	32.445	12.000	11.800	13.000	12.500	26.000	98.688

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

Dec. 1959	Silver (c) New York	Silver London	Sterling Exchange	Gold (d) London
1	91.375	80.250d.	280.0175	250s. 3¼d.
2	91.375	80.250d.	279.8440	250s. 5d.
3	91.375	80.250d.	279.6450	250s. 5¼d.
4	91.375	80.250d.	279.7080	250s. 8½d.
7	91.375	80.250d.	279.6560	250s. 8½d.
8	91.375	80.250d.	279.9725	250s. 7d.
9	91.375	80.250d.	279.8980	250s. 3½d.
10	91.375	80.250d.	279.8500	250s. 5¼d.
11	91.375	80.250d.	279.8800	250s. 4¾d.
14	91.375	80.250d.	280.0220	250s. 4d.
15	91.375	80.250d.	279.9580	250s. 3½d.
16	91.375	80.250d.	279.8860	250s. 4½d.
17	91.375	80.250d.	279.9360	250s. 5d.
18	91.375	80.250d.	279.9000	250s. 4½d.
21	91.375	80.250d.	279.8000	250s. 5¼d.
22	91.375	80.250d.	279.7400	250s. 6¼d.
23	91.375	80.250d.	279.7325	250s. 6¾d.
24	91.375	80.250d.	279.7266	250s. 7d.
25	Holiday			
28	91.375	80.250d.	279.7340	250s. 6¾d.
29	91.375	80.250d.	279.7800	250s. 8¼d.
30	91.375	80.250d.	279.9440	250s. 7½d.
31	91.375	80.250d.	279.9500	250s. 6½d.
AVERAGES FOR MONTH				
Dec.	91.375	80.250d.	279.845	—
AVERAGES FOR WEEK				
Dec.				
2	91.375	80.250d.	280.032	—
9	91.375	80.250d.	279.776	—
16	91.375	80.250d.	279.919	—
23	91.375	80.250d.	279.822	—
30	91.375	80.250d.	279.796	—

Calendar Week Averages: New York Silver: Dec. 4, 91.375; Dec. 11, 91.375; Dec. 18, 91.375; Dec. 25, 91.375; Dec. 31, 91.375.

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.400c per pound, the average differential for delivery charges.

(b) Export copper daily quotations are weighted averages based on sales outside the U.S. reported to E&MJ. Ocean freight and 0.125c lighterage and handling are deducted to arrive at the f.o.b. Atlantic seaboard refinery quotation. On f.a.s. U.S. sales lighterage of 0.125c is deducted.

(c) The c.i.f. Continental ports quotation is arrived at by adding to the f.o.b. export quotation lighterage, and the standard conference freight and insurance, Atlantic ports to main Continental ports. Currently this is 0.125c and 0.82c.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingots; cathodes are sold at a discount of 0.125c to 0.15c per pound. Quotations for zinc are based on Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East, Middle West, and West effective Sept. 2, 1959, commanded a premium of 1.25c per pound over the current market for Prime Western; Special High Grade 1.50c effective Sept. 2, 1959.

(f) Prime Western delivered where freight from E. St. Louis exceeds 0.500c.

Quotations for lead are based on domestic common lead. Corroding lead commands a premium of 10 points (almost all U. S. lead is corroding grade).

(c) The daily silver quotations reported by Handy & Harman, in cents and fractions of a cent per troy ounce, is the price paid by Handy & Harman in settlement for silver contained in unrefined silver-bearing materials submitted to them for refining. It is determined on the basis of offers of bar silver .999 fine as made to Handy & Harman for nearby delivery at New York by regular suppliers in quantities sufficient to meet daily requirements, and it is usually 0.250c below the price of which such offers are made.

The Treasury's purchase price of newly mined domestic silver is 90.5c per troy ounce 1000 fine effective July 1, 1946. London silver in pence per troy ounce, basis 999 fine.

(d) U. S. Treasury's gold price is $35. Actual payment by the United States Treasury for gold is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

MARKETS (*Continued*)

London Metal Exchange Quotations

Dec.	Copper Cash Bid	Copper Cash Asked	Copper 3 Mon. Bid	Copper 3 Mon. Asked	Lead Current Month Bid	Lead Current Month Asked	Lead 3 Mon. Bid	Lead 3 Mon. Asked	Zinc Current Month Bid	Zinc Current Month Asked	Zinc 3 Mon. Bid	Zinc 3 Mon. Asked	Tin Cash Bid	Tin Cash Asked	Tin 3 Mon. Bid	Tin 3 Mon. Asked
1	239½	240	234¼	234½	71¼	71⅝	71⅞	72	94	94¼	89½	89¾	793	794	788	788½
2	248	248½	237¾	238	72¼	72⅝	72¼	72⅝	95¼	95½	90¼	90½	794	794½	790	791
3	250	251	238½	238¾	71¼	71½	71⅛	71⅝	94½	94½	89½	89¾	791	791½	788	789
4	251	252	237½	238	71⅛	71⅛	71⅛	71⅝	94½	94¾	89⅝	89¾	789	791	788½	789
7	255½	256	239½	240	71⅛	71⅝	71⅝	71⅞	94¾	95	89⅞	90	786	788	784	786
8	255½	256	239½	240	71⅛	71⅝	71⅝	71¾	95¼	95½	90¼	90¼	792	794	788½	789
9	258½	259	242	242½	71⅛	71⅜	71¾	71⅞	96	96⅛	90¼	90⅜	792½	793½	789½	790
10	257½	258	241	241½	71⅜	71⅞	71¾	71⅞	96¾	97	90½	90⅝	792½	793	789½	790
11	259	259½	241¾	242	72	72¼	72	72¼	97	97¼	91	91⅛	791	791½	787	788
14	255½	256	237½	238	71⅝	71⅞	71⅝	71¾	95	95¼	89⅝	89¾	788½	789	783	784
15	252	252½	236	236½	71⅜	71⅞	71½	71⅝	96	96¼	90½	90¾	787½	788	781½	782
16	255	255½	239½	240	72⅛	72¼	72⅛	72¼	95	95¼	90¼	90½	788½	789	783	784
17	251	251½	236	236½	72⅝	72½	72¼	72¼	94½	95	90¼	90¼	787	788	783	784
18	251½	252	236½	237	73	73⅛	72⅝	72½	93¼	93½	89½	89¾	788½	789	784	784½
21	260	261	241½	242	73	73⅛	72⅝	72½	93¾	94	89¾	90	788	788½	783	783½
22	258	258½	240½	241	73¾	73⅞	73	73½	94¼	94½	90¼	90½	788	788½	783½	784
23	259	259½	241	241½	74¼	74½	73¼	73¾	95	95¼	90¼	90½	789½	790	784	784½
24	260	260½	241	242	74	74¼	73¼	73½	95¼	95½	90¼	90⅝	787	787½	783	783½
25	Holiday															
28	262	262½	243	243½	74½	74¾	73⅝	73¾	95¾	96	90¼	90⅝	784	784½	782	782½
29	262	262½	244½	245	75½	75⅝	74¼	74¾	96	96¼	90⅝	90½	785	786	782	782½
30	258	258½	241	241½	73⅞	74	73¼	73½	95⅝	95½	90	90¼	785	786	782½	783
31	255	255½	239¾	240	73¾	74	73½	73¼	94¾	94⅞	89¾	90	785	785½	782	782½
Av'g's	£255.443		£239.756		£72.696		£72.452		£95.190		£90.162		£789.159		£785.330	

Prices are for the official a.m. session in pounds sterling per ton of 2240 lb. Copper basis wire bars, lead 99.9%, zinc 98% and tin min. 99.75%.

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipments, f.o.b. New York unless otherwise stated, tons of 2,000 lb unless otherwise noted. st—short ton; lt—long ton; stu—short ton unit; ltu—long ton unit. (p) duty paid.

MISCELLANEOUS METALS

Dec. 31, 1959

Aluminum ingot, 99 plus % lb		28.1c
Antimony, spot, lb, less than carload, in cases		32.59c
In bulk, carload lots, f.o.b. Laredo		29.00c
Imported. 10 ton min. (p). 99⅛%		24½c
Bismuth, ton lots, lb		$2.25
Cadmium,ton lots delivered, lb		$1.30
small lots		$1.40
Calcium, lb, ton lots, 98%, cast		$2.05
Chromium, 97% grade, lb, contract delivered		$1.29
Cobalt, 97 to 99%, per lb effective Feb. 1, 1957		$1.75
Germanium, per gram, 10,000 gram lots	(d) 33c —(c)	(d)35c
Indium, troy oz	$1.25 —	$2.25
Lithium, lb, 98%	$9.00 —	$11.00
Nickel, cathodes, lb (a)		74c
Other sales, regular sellers		74c
Sales by dealers, etc		74c
Magnesium, 99.8% carloads, lb producer's plants, Velasco, Texas, effective Apr. 16		35½c
Palladium, troy oz	$22.00 —	$24.00
Platinum, troy oz	$77 —	$80
Quicksilver, flask of 76 lb, 25 flasks or more	$212 —	$214
Selenium, 99 plus %, lb—(Feb. 19, 1958)		$7.00
Silicon, minimum 98%, carloads, lb		19c
Semi Conductor grade, lb		$360
Tellurium, lb		$2.50
Thallium, 100 lb or more		$7.50
Titanium, 99.3% plus, grade A-1, max. 3% Fe, lb (b)	$1.50 —	$1.60

(a) Effective Dec. 6, 1956; including U.S. duty; (b) Effective Aug. 1, 1959. (c) Delivered; (d) f.o.b. plant.

METALLIC ORES

Beryllium ore, imported, 10% BeO, (b) stu: spot		$31.75–32.50
term contracts		$34–34.50
Chrome ore per long ton, f.o.b cars Atlantic ports, dry: 44% Cr_2O_3 no ratio	$18.25—	$19.00
48% Cr_2O_3 3 to 1 ratio	$34 —	$37
Iron ore, Lake Superior, Lower Lake ports, lt		
Old Range bessemer		$11.85(e)
Mesabi bessemer		$11.60(e)
Mesabi non bessemer		$11.45(e)
Lead (Galena), 80%, Joplin, Mo., ton		$141.72
Manganese ore—Per ltu of Mn basis 48%, nearby positions, subject to premiums and penalties, c.i.f. U. S. ports import duty extra., (n)87c—90c. Long-term contract nominal.		
Molybdenum ore, 90%, per lb of Mo f.o.b. mines		$1.25
Columbian-Tantalum, per lb, combined oxides 10 to 1 ratio	$1.10 —	$1.20
Tungsten ore, per stu of WO_3:		
Foreign 60%, c.i.f. U.S. ports, duty extra	$18.25—	$19.00
U. S. scheelite, f.o.b. mill	$22 —	$24
Vanadium ore, per lb of contained V_2O_5 f.o.b. mines		31c
Zinc ore, Prime, 60% concentrate, Joplin, Mo., per ton		$76

(a) Nominal. (b) c.i.f. U.S. ports. (e) Effective 1958 shipping season.

METALLIC COMPOUNDS

Arsenous oxide (arsenic trioxide) lb, in bbl, carload lots N. Y. docks		4–5c
Cobalt oxide, 72½% to 73½%, per lb, effective Dec. 1, 1956	$1.33 —	$1.36
Copper sulphate, 100 lb, effective Nov. 6, '59		$13.00
Germanium dioxide, gm		18½c
Molybdic trioxide, technical, per lb of Mo	$1.46 —	$1.47
Imported, including 37c duty	$1.75 —	$2.05

ALLOYS

Ferrochrome 65 to 70%, per lb of Cr, (4-9% C)		28¾c
Ferromanganese, 74 to 76%, per lb shipping point		12¼c
Ferromolybdenum, 58 to 64% Mo. Lb of Mo contained	$1.50 —	$1.82
Ferrosilicon, 50% per lb of Si f.o.b. shipping point (3-1957)		14.60c
Ferrotungsten, 72 to 82%, lb of W contained		$2.15
Ferrovanadium, per lb of V delivered	$3.20 —	$3.40
Silicomanganese, max. 1½% c, lb contracts		12.8c
Spiegeleisen, per lt, 10—21% grade effective Jan. 7		$102.50

NONMETALLIC MINERALS

Asbestos, f.o.b. Canada (Quebec) mines (Canadian funds) ton:			
Crude No. 1	$1,400–$1,725	Paper Stock	$120–$142
Crude No. 2	$750–$1,155	Waste	$75– $86
Spinning Fibers	$350– $565	Shorts	$40– $75
Shingle fibers	$180– $220		
Asbestos, f.o.b., Vancouver, B. C. (Canadian funds):			
Crude No. 1	$1,522	Spinning fibers	$220–$787
Asbestos, Vermont, f.o.b. Morrisville:			
Spinning fibers	$353– $408	Waste, stucco or plaster	$86
Shingle stock	$181– $218	Refuse or shorts	$41– $75
Paper stock	$120– $142		

Barytes f.o.b. cars:		
Georgia, crude, per ton		$18
Missouri, 94%, $BaSO_4$, per st	$16 —	$18
Crude oil well grade, min. 4.3 sp gr, st (a)		$18
Imported, c.i.f. Gulf Ports, st	$16 —	$18
Bauxite, st, f.o.b. point of shipment:		
Domestic, crude, 50%, 8% Fe, 13% Si	$12.25 —	$13.50
Imported metallurgical, per lt, f.o.b. Br. Guiana, depending on grade		$7.14
Feldspar, bulk ton:		
Potash or soda feldspar, 200 mesh, ceramic grade	$20.50 —	$21
Glass feldspar, white, 20 mesh		$9
Fluorspar, f.o.b. mines, bulk, 72½% effective, ton	$37 —	$41
60% effective CaF_2	$33 —	$36.50
Acid 97% concentrate, bulk, ton		$45.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00 —	$14.00
Magnesite, per ton dead-burned, bulk, f.o.b. Washington		$46

Mica—Domestic, f.o.b. mines. Punch 7c—12c per lb according to size and quality. Sheet clear 1½x2 in, 70c—$1.10; 2x2 in, $1.10 to $1.60; 2x3 in, $1.60—$2.10; 3x3 in, $1.80—$2.30; 3x4 in, $2.00—$2.60; 3x5 in, $2.60—$3.00; 4x6 in, $2.75—$4.00; 6x8 in, $4.00—$8.00. Wet ground, very fine, $140—$155 per ton, Bulk sales, dry ground; $30—$55 per ton. Scrap $20—$30.

Ocher Georgia, ton in sacks	$26.50 —	$32.00
Sulphur, long ton, U. S. producers' posted quotations*		
f.o.b. mines, bright		$23.50
dark		$22.50
f.o.b. vessel, bright		$25.00
U. S. ports, dark		$24.00
Mexican, for use in Mexico, per metric ton, f.o.b. mines, 280 to 395 pesos, depending on location	$22.40 —	$31.60
For export f.o.b. vessel, lt, depending on grade	$20.50 —	$22.00
Talc, f.o.b. works, ton:		
New York, purified	$18.00 —	$20.00
Vermont, extra fine		$12.50
Tripoli, Missouri, ton:		
40-mesh, cream colored		$50.00

*Prices will vary from these depending on the competitive situation; currently U.S. sulphur sells at close to Mexican export prices

(a) Some restricted sales at $11.50, (b) Corrected. (c) Nominal.

IRON AND STEEL

Pig iron, gross ton, basic, Valley furnaces		$66.00
Steel, f.o.b. Pittsburgh, billets, net ton		$80.00
Structural shapes, Pa., Ala., etc., 100 lb	$5.30 —	$5.50

B.F.Goodrich

B.F.Goodrich tires haul 50 tons of coal over limestone roads

Central Ohio Coal Comp.ny owns and operates the Muskingum strip mine in southeastern Ohio. Monthly production averages 200,000 tons of coal, carried from mine to dump by giant haulers. The one above carries 50 tons on the 8-mile trip over roads topped with crushed limestone.

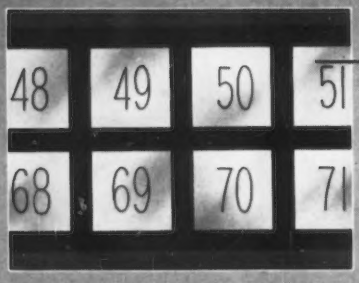
There's a job for the toughest tires available—B.F.Goodrich Rock Service tires. BFG builds the Rock Service with a specially compounded tread that defies rock cuts and snags. Double-chevron cleats pull in forward or reverse, guard against dangerous skids. And the B.F.Goodrich FLEX-RITE NYLON cord body withstands double the impact of ordinary materials. It resists such tire-killers as heat blow-outs and flex breaks. Result: more retreadable Rock Service tires and more retreads per tire!

Take a tip from successful mine operators — call your B.F.Goodrich Smileage dealer today. He is listed under Tires in the Yellow Pages of your phone book. He has a complete line of money-saving B.F.Goodrich tires for every type of mine work. *The B.F.Goodrich Company, Akron 18, O.*

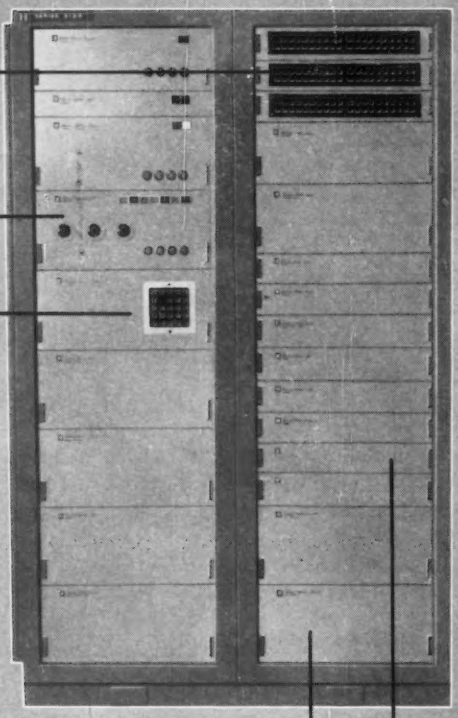
Specify B.F.Goodrich Tubeless or tube-type tires when ordering new equipment

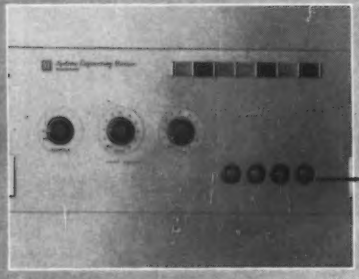
B.F.Goodrich *off-the-road tires*

New packaged

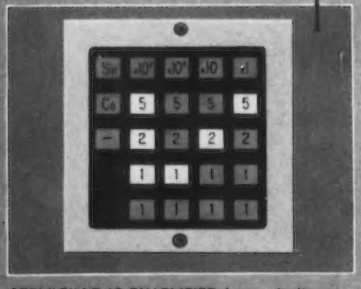


THREE 40-POINT ANNUNCIATORS make it easy for the operator to tell at a glance which variables are off-normal.

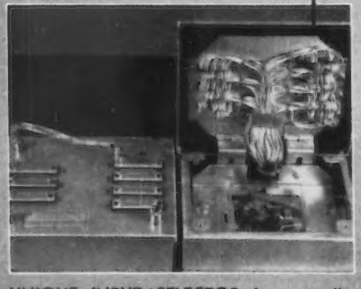




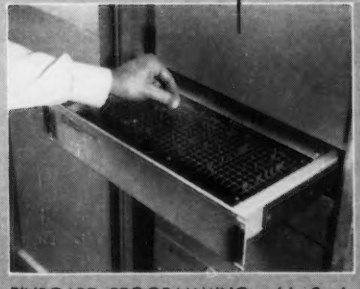
DIGITAL VISUAL DISPLAY and variable selector switches make it easy to select any single variable and watch all trends and changes continuously.



SERVICING IS SIMPLIFIED by an indicator-light panel showing the completion of each step in the analog to digital conversion. The sequence programmer can be changed from automatic to hand advance to permit operator to check each step.



UNIQUE INPUT SELECTOR is unusually dependable because of its sealed, oil-immersed construction. Servicing is normally limited to visual inspection every 6 months. Drawers pull out so voltage checks can be performed without shutting down system.



PINBOARD PROGRAMMING adds flexibility. You can change the logging or scanning sequence at will . . . substitute one type of input for another. Range, span, and zero adjustment are set by inserting pins in their proper places. No calculations are required. The pinboards are pinned in familiar units of measurements.

Honeywell logger-scanner

...accurate within ± 0.1% of reading

...pinboard programming for maximum flexibility

Here's a standard, all-purpose 120-point logger-scanner system with features formerly found only in more expensive, custom-designed equipment . . . the first of several packaged logger-scanners being introduced by Honeywell. It offers the ultimate in accuracy, flexibility, dependability and simplicity of maintenance. Wide ambient temperature operating limits—60 to 120°F—eliminate the need for special air conditioning equipment.

The Series 3120 accepts signals from primary measuring instruments—thermocouples, flow, pressure or other transducers. It measures these signals, digitizes them, and prints their values in immediately usable form. A thermocouple reference oven can be supplied to accommodate three types of thermocouple inputs—types T, J, and K—which are automatically linearized over their entire range to within 0.1% accuracy.

The operator can select either automatically or manually initiated logging cycles. He can set the system to log all variables automatically at preset intervals, or manually energize the system to operate on demand, between logging cycles.

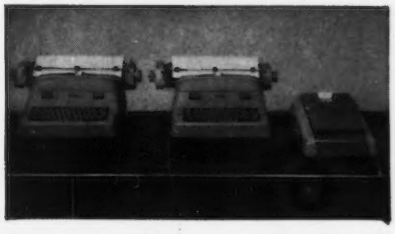
Between logging cycles, the system can scan off-normal alarm points—high, low or both—at a rate of 7 points per second. Upon detecting an off-normal point, the system sounds an alarm, lights a point-identification light, and prints the time, point number and off-normal value on adding machine tape. During log cycles, off-normal points are printed in red on the log sheet.

Get complete details from your nearby Honeywell field engineer. Call him today . . . he's as near as your phone. MINNEAPOLIS-HONEYWELL, Wayne and Windrim Avenues, Philadelphia 44, Pa.

75th YEAR PIONEERING THE FUTURE

Honeywell

H HONEYWELL First in Control SINCE 1885



TWO TYPEWRITERS permit a single line log allowing columnar comparisons. Separate alarm printer records all off-normal variables.

STANDARD MODULAR COMPONENTS are assembled on chassis mounted as individual drawers in relay racks. All drawers are connected by plugs for easy servicing.

For extra high strength wire rope...
use CF&I-Wickwire *Double Gray*

The CF&I Image reflects CF&I's experience as a producer of many steel products and CF&I's versatility in developing new products to meet exacting requirements . . . like Wickwire Double Gray*.

The special steel used in Double Gray provides extra resistance to the deforming effects of peening and crushing which occur on the drums and sheaves of heavy equipment. Double Gray also gives extra resistance to abrasion.

Because of these superior qualities, Double Gray rope quickly repays its slightly higher initial cost in safer, more economical operations. Use it wherever extra high strength wire rope is required.

For a free copy of our Double Gray booklet, write to: Advertising Department, The Colorado Fuel and Iron Corporation, 575 Madison Avenue, New York 22, N. Y.

**Wickwire Double Gray Wire Rope is made of extra-improved plow steel. Fortified by an independent wire rope core of the same extra high strength steel, Double Gray rope has a 15% higher breaking strength than the catalog breaking strength of an improved plow steel rope with IWRC.*

6632

WICKWIRE ROPE

THE COLORADO FUEL AND IRON CORPORATION

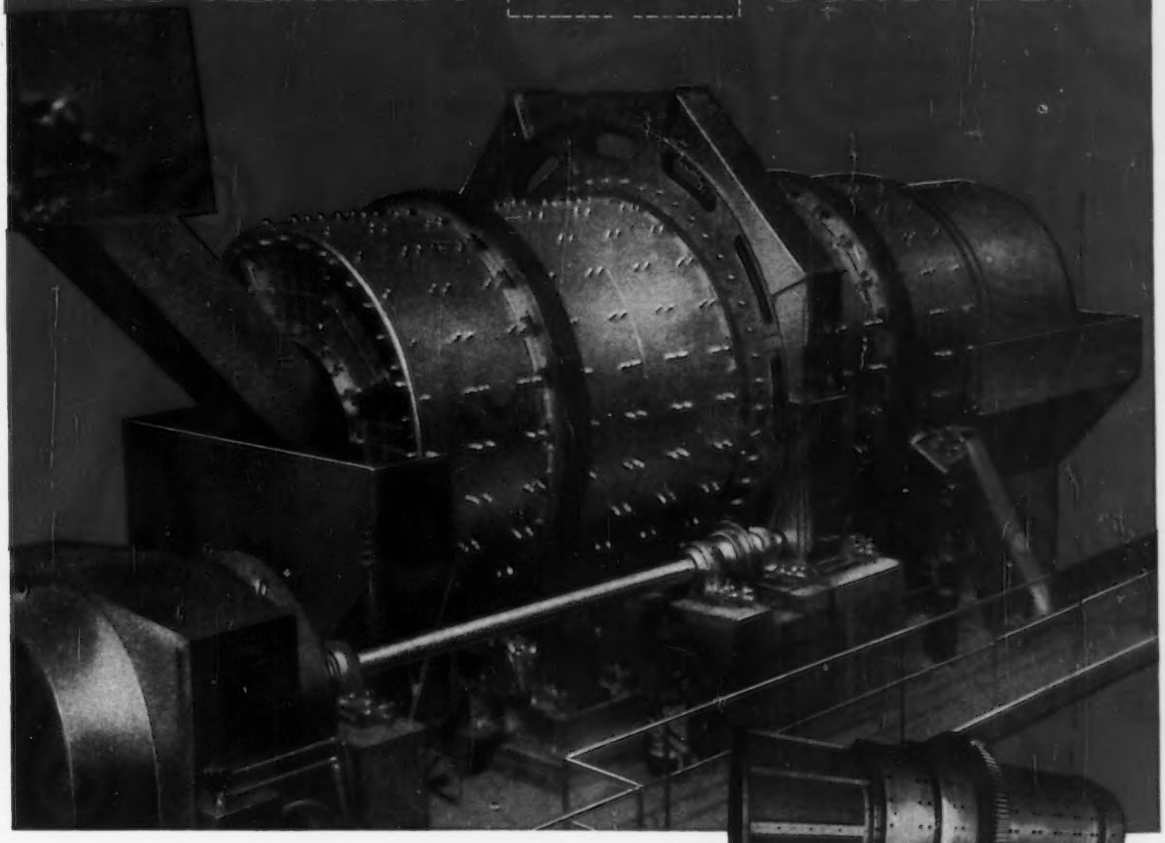
In the West: THE COLORADO FUEL AND IRON CORPORATION—Albuquerque · Amarillo · Billings · Boise · Butte Denver · El Paso · Farmington (N.M.) · Fort Worth · Houston · Kansas City · Lincoln · Los Angeles · Oakland · Odessa (Tex.) Oklahoma City · Phoenix · Portland · Pueblo · Salt Lake City · San Francisco · San Leandro · Seattle · Spokane · Tulsa · Wichita

In the East: WICKWIRE SPENCER STEEL DIVISION—Boston · Buffalo · Chattanooga · Chicago · Detroit · Emlenton (Pa.) New Orleans · New York · Philadelphia

CF&I STEEL

A Cleaner Product Is A More Saleable Product

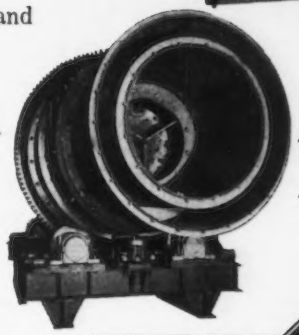
The KENNEDY HEAVY DUTY SCRUBBER



With thoroughly cleaned rock or ore secondary and tertiary crushing and screening operations become more efficient. Control is improved and products are of higher quality. Downtime for blocked crushers or blinded screens is eliminated.

The KENNEDY Heavy Duty Scrubber is outstanding because of these features:

- **All welded steel shell**
- **Wear resistant, replaceable liners**
- **Replaceable cast alloy lifters for advancing material**
- **Spherical roller bearings**
- **Cut gear and pinion**
- **Enclosed gear reducer drive**
- **Extra heavy structural steel base**
- **Counter flow of material and wash water**
- **Single, double or multiple trommel for dewatering and sizing**



View showing rotary kiln type carrying stations with spherical roller bearing pillow blocks and extra heavy base.

Discharge end of scrubber with double trommel. Dirt and clay wash through outer trommel; sized material discharges off end. Oversize discharges off end of inner trommel.

Let us help you adapt this scrubber to your process.

KENNEDY VAN SAUN
MANUFACTURING & ENGINEERING CORPORATION

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PRIMARY & SECONDARY GYRATORY CRUSHERS • JAW CRUSHERS • ROLL CRUSHERS • IMPACT BREAKERS • HAMMER MILLS • ROD & BALL MILLS • KILNS • KILN ACCESSORIES • DRYERS • SCREENS • MECHANICAL & PNEUMATIC CONVEYORS • COMPLETE CRUSHING, LIME, CEMENT & CARBON PASTE PLANTS. KENNEDY RESEARCH & TESTING SERVICE.

Keep in touch with the job

with Collins 32RS-1 Transceivers

Collins 32RS-1 is a radio communication system that offers phone-line convenience where phone service is nonexistent. It keeps you in contact with distant operation sites.

Through a new communication method known as single sideband, Collins 32RS-1 provides four times the talking power of equally powered conventional carrier radio equipment. You get big system dependability in a table-top unit.

Designed for ease of operation — A control automatically actuates the transmitter when you talk, turns on the receiver when you stop talking — lets you operate through a switchboard or extension telephones. Just a flick of a switch selects one of four pre-tuned frequencies. Each is crystal-controlled to assure precise positioning. Highly stable circuits always keep you on your operating frequency. Collins exclusive mechanical filtering system gives sharper, clearer transmission — excellent selectivity in reception.

Economical to maintain — All components and adjustment controls are readily accessible. Collins simplified, tested design gives you inexpensive, reliable communication for many years.

Compact, self-contained — The 32RS-1 installs quickly, moves easily, requires only an antenna and a power source. It's also available as a mobile unit in the 32M series.

Other equipments in the complete Collins SSB line provide from 2.5 to 45 kilowatt outputs — with manual or automatic tuning.

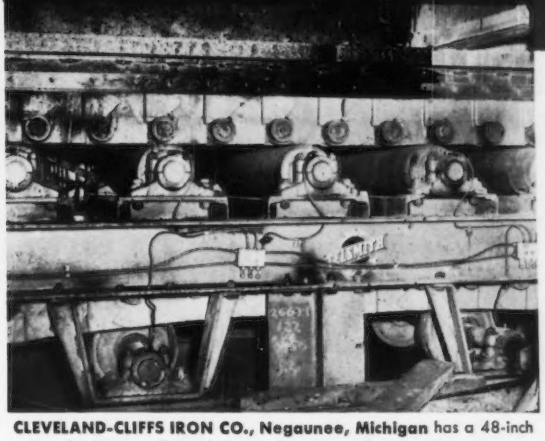
For further information, write Radio Communication Sales, Collins Radio Company, Cedar Rapids, Iowa, U.S.A.

COLLINS

COLLINS RADIO COMPANY • CEDAR RAPIDS, IOWA • DALLAS, TEXAS • BURBANK, CALIFORNIA

TELSMITH

more economical feeders



CLEVELAND-CLIFFS IRON CO., Negaunee, Michigan has a 48-inch wide x 14-foot long Telsmith Heavy-Duty Apron Feeder with manganese steel flights, feeding a 25 x 36 Telsmith Roller Bearing Jaw Crusher. Capacity is about 3000 tons per day.

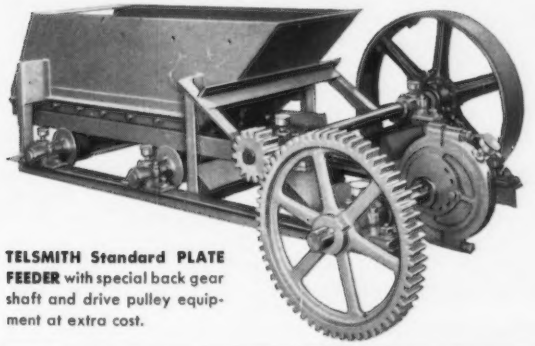
● Keep your conveyors, screens and crushers working smoothly and at full capacity. Telsmith Apron or Plate Feeders insure steady, uniformly regulated flow of material to entire plant—boost your output and cut cost of up-keep.

APRON FEEDERS are self-contained units on heavy structural steel frames. **Heavy-Duty Apron Feeders**—with carbon, or manganese steel flights—handle the toughest jobs, such as feeding primary crushers, either jaw or gyratory. **Standard-Duty Apron Feeders**—equally sturdy, but weigh less. Apron Feeders are made in 24-in. to 72-in. widths, with capacities from 25 to 800 tons per hour. Furnished with heavy steel hoppers, at extra cost.

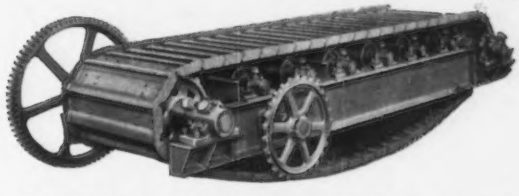
PLATE FEEDERS are simple in design—sturdy in construction. Adjustable stroke regulates capacity. Made in both Standard and Heavy-Duty models; widths 16-in. to 60-in.; capacities 12 to 740 cu. yds. per hr.

Send for Bulletin 266

F-1-Min.



TELSMITH Standard PLATE FEEDER with special back gear shaft and drive pulley equipment at extra cost.



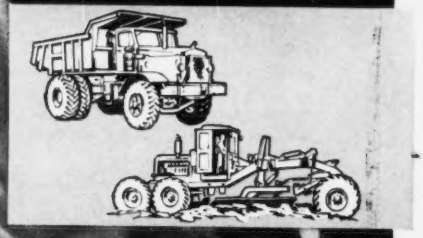
TELSMITH Standard-Duty APRON FEEDER—Raised edges of its ⅜-in. steel flights prevent spillage.

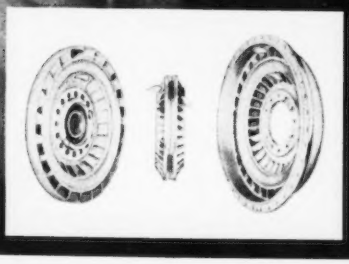
SMITH ENGINEERING WORKS

502 E. CAPITOL DRIVE **MILWAUKEE 1, WISCONSIN**

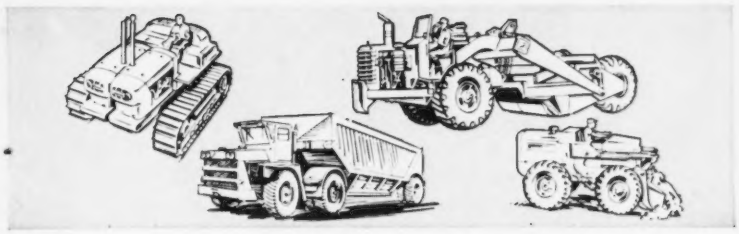
Representatives in Principal Cities in All Parts of the World • **Cable Address: Sengworks, Milwaukee**

What's it costing





you to keep the "stick"



EVEN IF YOU HAVE only top operators on all your equipment, the cost of keeping a stick-shift comes to a pretty penny: too-frequent, high repair bills for unavoidably shock-loaded drive lines and axles—engines being overhauled twice as often as necessary at $1,200 to $1,500 per overhaul—and, of course, those incessant clutch repairs and replacements.

No Operator Matches TORQMATIC Efficiency—

—for no operator can handle the stick as smoothly and efficiently—*every* time—as an Allison TORQMATIC DRIVE.

TORQMATIC adjusts your engine output and speed—automatically—to meet every change in load or terrain. It never fatigues—no matter how long or how tough the job. It needs no costly training—in fact, TORQMATIC owners report they're saving between $1,500 and $2,000 every time they train a driver because rookies can't make a shifting or clutching mistake.

It's Working for You or Against You

So it's easy to see that a TORQMATIC DRIVE is a real money saver. One thing is sure: you're either cashing in on its advantages on every job you bid for—or competing against men who do, who bought TORQMATIC because they looked at *total* cost, not just *first* cost.

And remember—TORQMATIC is available in almost every type—and well over 100 makes—of equipment. It's been proved—on years of tough jobs—far beyond any other hydraulic transmission. Just see your dealer—or write Allison for details.

ALLISON DIVISION OF GENERAL MOTORS
Indianapolis 6, Indiana

In Canada: General Motors Diesel Ltd., London, Ontario

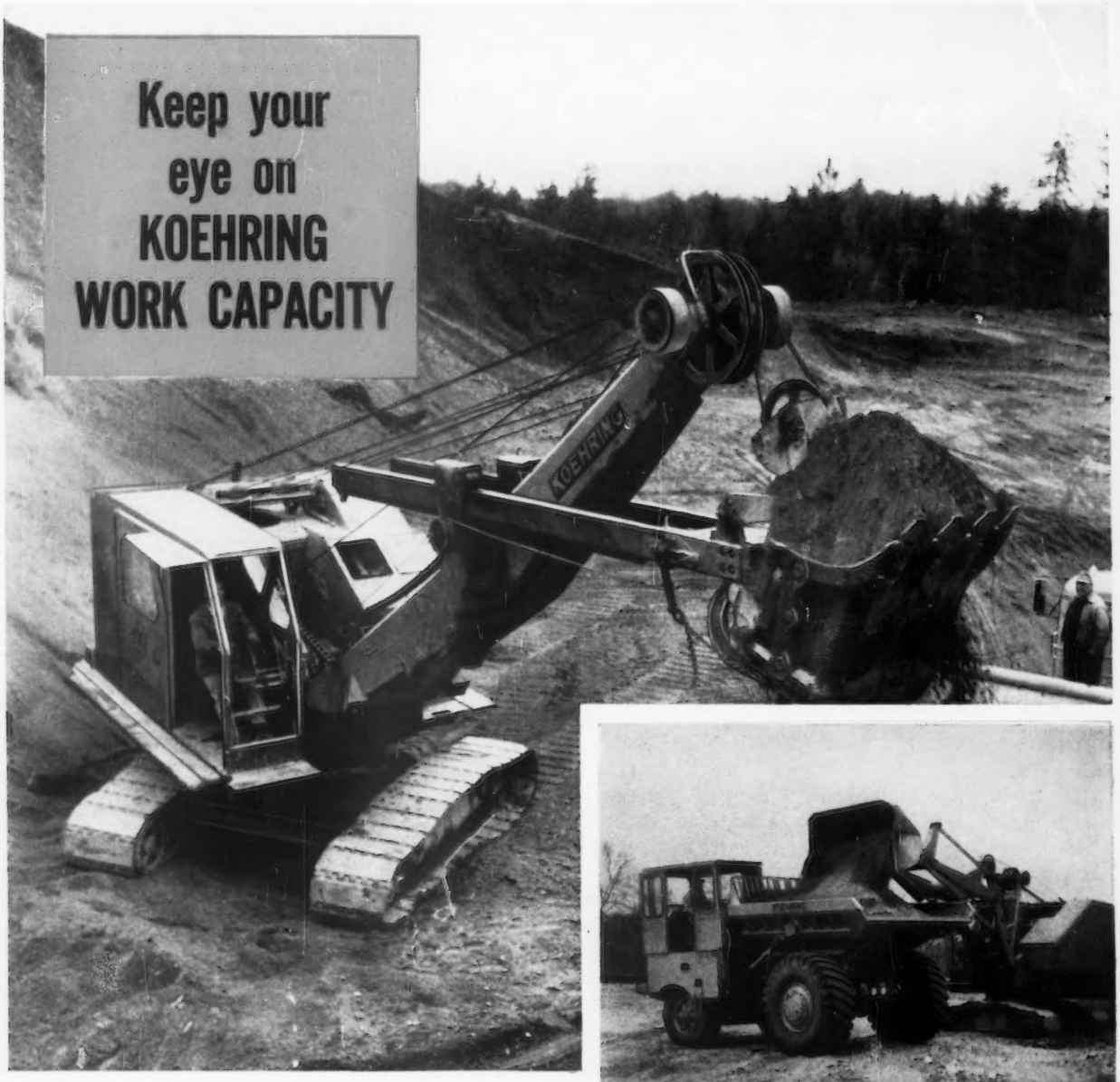
Allison TORQMATIC

TORQMATIC® DRIVES

THE MODERN DRIVE FOR MODERN EQUIPMENT

Built stronger to last longer—Allison casts its converter for extra strength, greater precision—and the converter is *integrated* with the transmission for a neat, easily serviced installation.

Keep your eye on KOEHRING WORK CAPACITY



Loading pit-run gravel — Fast-swinging 1-yard shovel accurately spots load "on target", keeps trucks on the move. For all its power and speed, 405 is easy on the operator. Big 26-inch main-drum power clutches require only *1/10th* the lever pull of comparable-size manual clutches — yet retain sensitive "feel" of load. Pays off in less operator fatigue — more output with all attachments: shovel, hoe, clamshell, dragline, lift crane and piledriver.

2 new products for mining and quarrying: (1) Koehring® 205 SKOOPER — a full-revolving, free-swinging 2-yard loader that crowds, hoists, swings, dumps, then swings back to digging position *without traveling*. Crowds bucket along a 7-foot level cut from *"stand-still"* position, or digs at any angle of bank slope. (2) That big hauler is the new Koehring *15-ton* Dumptor® — with 2-way controls, pivoting seat, 24 mph speeds in *both* directions for *no-turn* hauling. 30,000-lb. payload capacity. 28½% gradability. *Instant* gravity-dump or *controlled* gravity-dump by hydraulic cylinders.

KOEHRING
DIVISION OF KOEHRING COMPANY
Milwaukee 16, Wisconsin

Koehring excavators, cranes also manufactured in:
ENGLAND • SPAIN • JAPAN

In Canada:
KOEHRING-WATEROUS LTD.
Brantford, Ontario

Rocky overburden on steep, mountainous site made stripping conditions as tough as they come at this coal mine. No job for ordinary equipment! So, mine owner brought in a Koehring heavy-duty 1205 rock shovel, with results shown above. It's equipped with 3-yard dipper on 30-foot rock-type boom. Also available as *high-lift shovel* with 2½-yd. dipper on *50-foot* boom; 3-yard on *40-foot* boom.

Long-reach dragline loads sand and gravel out of deep, water-filled pit. It's the Koehring 805 — a special-size that fills an important production gap on many mine and quarry operations. Depending on weight of materials, 805 handles 2 to 3-yard dragline bucket on 50 to 150 feet of boom. What's more, this high-production 805 readily converts to clamshell crane, 52-ton lift crane, or 2-yard shovel.

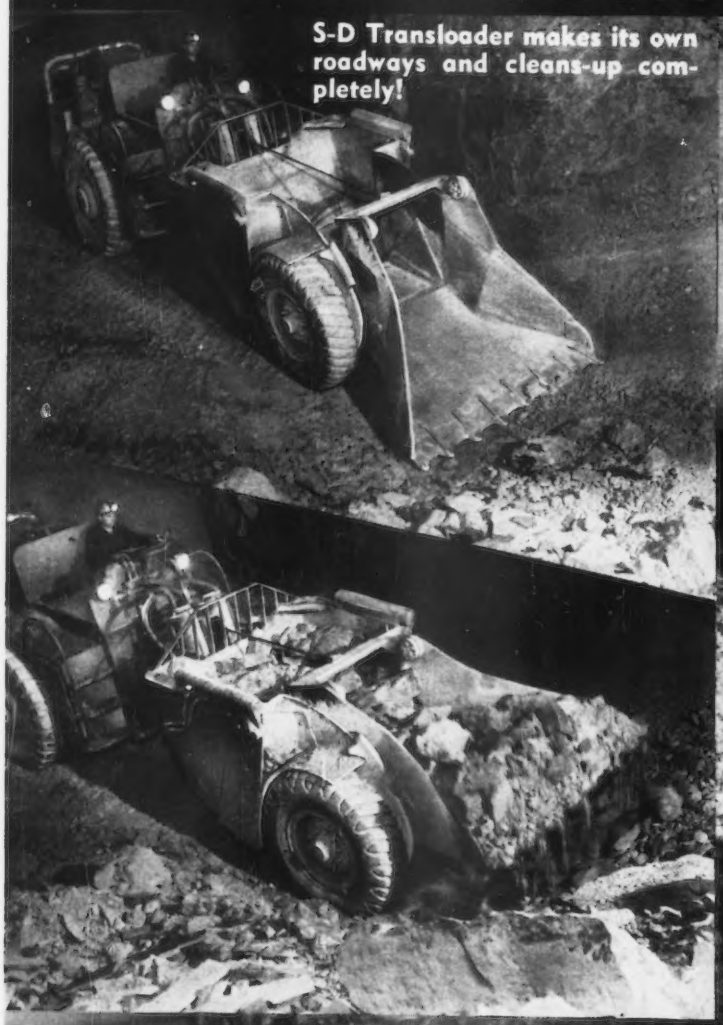
Always on the go — Wherever there's a heavy load to lift, machinery to install, materials to stockpile, big mobile 545 truck crane is *there* in a matter of minutes — puts all scattered assignments on a fast "work-and-run" basis. Lifts up to 45 tons with 40-foot boom *at 15-foot radius!* Angle indicator on boom, plus reference guide in crane cab, quickly show maximum safe lift capacity for any length of boom and angle of boom being used.

Swinging a skull-cracker in stone quarry, heavy-duty crane pulverizes oversize slabs and chunks of blasted rock. It's a profitable way to speed shovel loading, step up production at the crushing plant. The crane is a Koehring crawler-mounted 305. Truck or Cruiser mounting also available. As a self-propelled Cruiser® crane, the 305 combines one-man operation with travel speeds up to 18 mph — serves several widely-separated mines or work areas. Puts scattered material-handling, lifting jobs on a fast work-and-run basis. Lift capacity? 25 tons at 12-foot radius!

Get more work capacity per dollar of equipment investment — check Koehring before you buy your next excavator or crane.

K16

The S-D TRANSLOADER® is doing



S-D Transloader makes its own roadways and cleans-up completely!

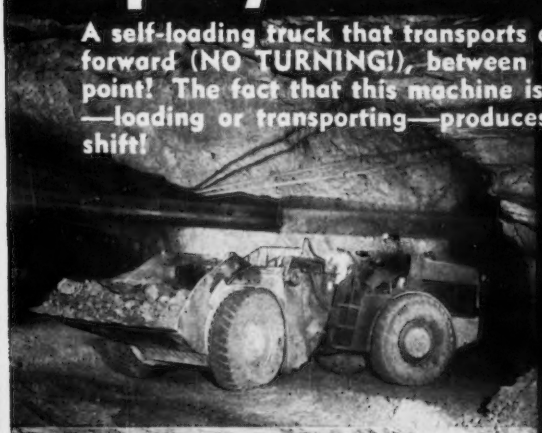
All wearing surfaces feature T-1 Steel (a new high strength readily welded alloy).

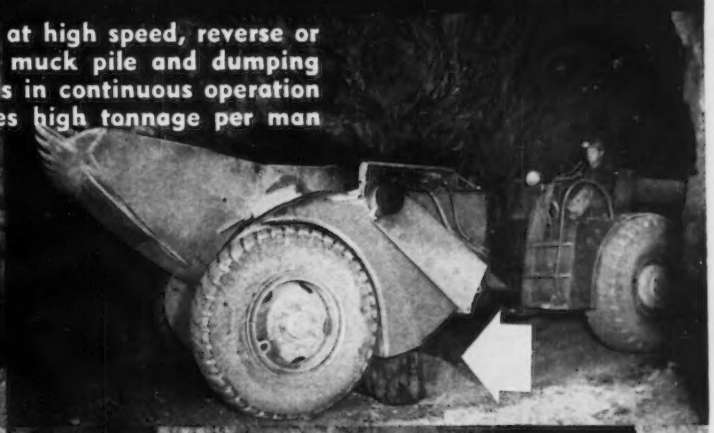
VERSATILE! Handles large boulders . . . moves them aside for secondary blasting!

ONLY MACHINE ON THE MARKET THAT SELF-LOADS AND TRANSPORTS!

a job you cannot afford to overlook!

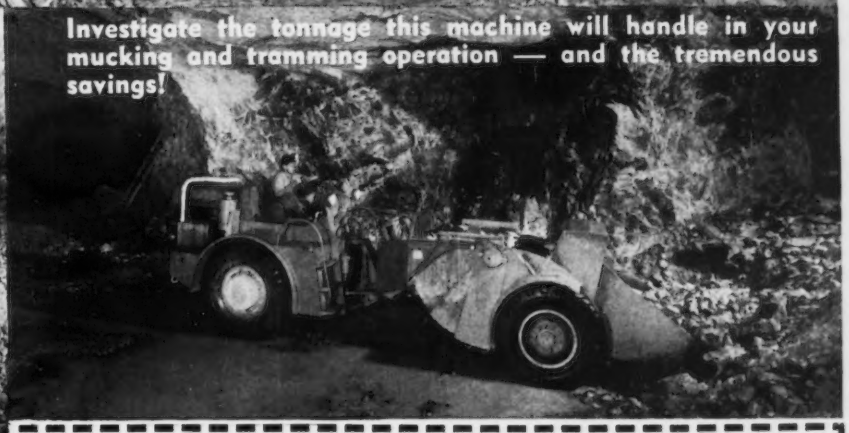
A self-loading truck that transports at high speed, reverse or forward (NO TURNING!), between muck pile and dumping point! The fact that this machine is in continuous operation —loading or transporting—produces high tonnage per man shift!





These S-D Transloaders are but a few of the many in several operations . . . each and all doing a loading and haulage job that is producing high tonnage at tremendous savings!

Investigate the tonnage this machine will handle in your mucking and tramming operation — and the tremendous savings!



To SANFORD-DAY IRON WORKS, INC.
P. O. Box 1511, Knoxville, Tenn.

Gentlemen, please forward by return mail complete Information Packet, including time studies, specifications, etc., on the S-D Transloader!

SANFORD-DAY

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NEW! 30-YD CAPACITY

New Standards of

Plus the exclusive advantages of KON-TORK differential . . . a combination that means extra profit capacity for you—loading, hauling and spreading.

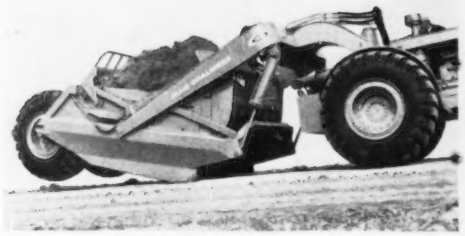
New 30-yd capacity . . . backed by 340 turbocharged horsepower gives you the size, the power and the durability to tackle any size job . . . I-system dirt, king-size dams, big state highway jobs.

The new *360* gives you more big-production features than any other big scraper, too: high-torque engine characteristics and snappy acceleration . . . full 90° steering . . . 10-ft apron lift . . . torque-proportioned traction . . . *plus* the new standards of all-hydraulic performance spotlighted at the right.

Get the full story on this all-new, all-hydraulic TS-360 from your Allis-Chalmers dealer now!

ALLIS-CHALMERS, CONSTRUCTION MACHINERY DIVISION, MILWAUKEE 1, WISCONSIN

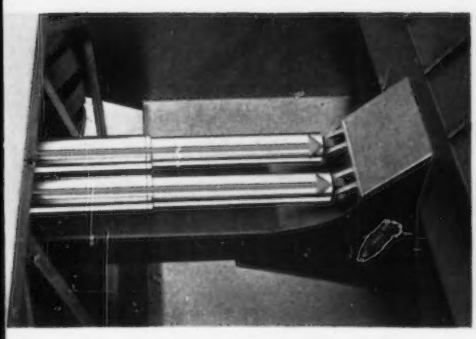
Everything you'd want in a big motor scraper if you were building it for your own jobs!

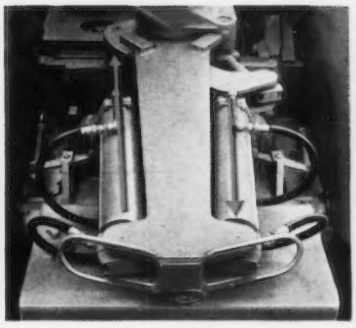


Double-acting bowl jacks put enough penetrating force on the cutting edge to pivot the *scraper and its load* clear of the ground.

KON-TORK is an Allis-Chalmers trademark.

All-Hydraulic Performance





Twin telescoping cylinders provide smooth, forced ejection of any material . . . without "pumping" tailgate.

Double-acting steering jacks are fed by an *independent* hydraulic system . . . assure two-speed steering power to match any situation.

KON-TORK differential automatically controls the distribution of torque to the drive wheels . . . for maximum traction to match any working condition.

move ahead with

ALLIS-CHALMERS

. . . power for a growing world

ENGINEER'S FIELD REPORT

PRODUCT CHEVRON PRESSURE PRIMER SYSTEM

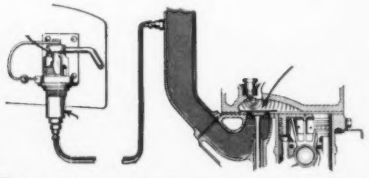
FIRM JONES-TOMKINS CO. Cougar, Washington

Special cartridge fires giant diesel in seconds

At world's highest earth-filled dam construction site near Woodland, Washington, three giant diesel shovels get immediate starts from Chevron Pressure Primer System, reports Jones-Tomkins, general contractors. System helps speed shovel's fill-borrowing operations for this $51,000,000 project. Five-year-old 4500 Manitowoc Speed Crane (above), powered by Caterpillar 350 h.p. V-12 D397 engine, operates 18 hours a day, six days a week, loading 21-yard dump trucks in just 70 seconds. Jones-Tomkins uses Standard fuels and lubricants exclusively on this job.

Chevron Pressure Primer Discharger mounted on instrument panel (left) operates satisfactorily despite heavy vibration, reports shovel foreman Henry Watson (right). "We've had absolutely no trouble with this system. The Chevron Pressure Primer System eliminates dust clogging and allows fluid to reach the cylinders quickly. It's the practical way we've found to get these rigs going."

Why Chevron Pressure Primer System assures fast starts



- Volatile Chevron Priming Fuel atomizes in induction system at all temperatures even at −65°F, no hand-pumping required.
- Pressure or weakest spark from engine fires mixture.
- Simple rugged air-tight discharger prevents Priming Fuel leakage.
- Small, fireproof, pressurized steel cartridges protect Priming Fuel from water and dirt.

For More Information or the name of your nearest distributor, write or call any of the companies listed.

CHEVRON

TRADEMARKS "CHEVRON" AND CHEVRON DESIGN REG. U.S. PAT. OFF.

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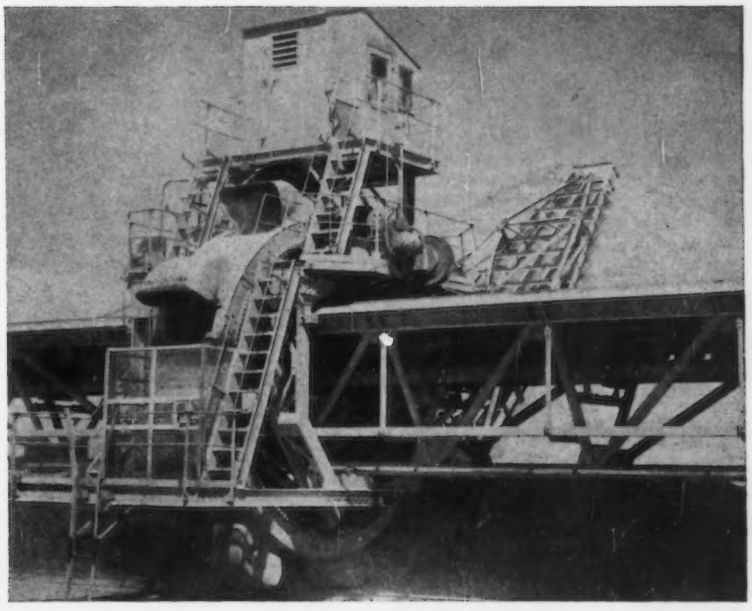
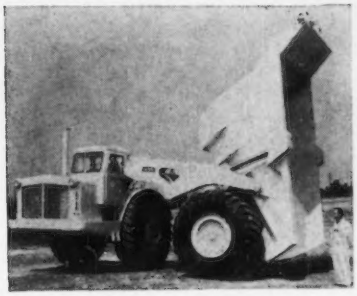
NEW PRODUCTS DIGEST

In this issue—a bucket wheeler for reclaiming material from stockpile, a 35-ton Euclid rear-dump, a floating fuel tank being used by South American Placers on the Kaka River, Bolivia, a blast furnace bosh plate and a furnace patching brick, American Ship's sewage disposal unit for the mine, a baghouse without moving parts, and many other new product and literature notices.

Bucket Wheeler Reclaimer (1)

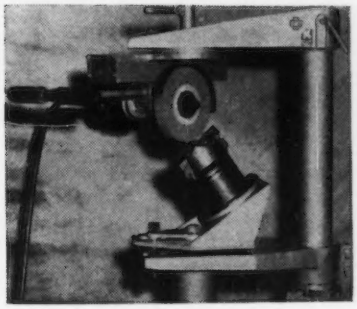
A BUCKET WHEEL as high as a three-story building is the key to a new blending and reclaiming machine designed by Hewitt-Robins, Inc. First installation is being made at American Cement Corp.'s Riverside plant, Oro Grande, Calif. Additional wheels are scheduled for other locations. The rotary wheel is fitted with two-ton buckets which dig and discharge 300 to 500 tph as the wheel moves from side to side as it advances into the stockpile. The wheel can be used as a blender if the stockpile has been laid down as layers of the various components of the charge, or it can be used simply as a reclamation device.





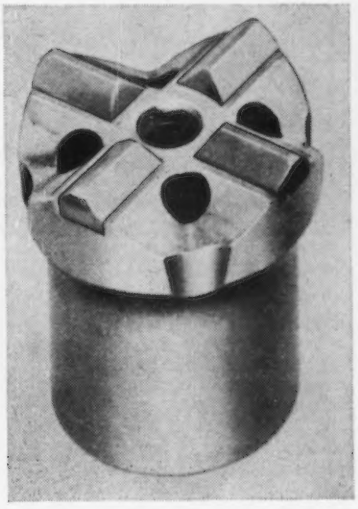
35-Ton Rear Dumper (2)

EUCLID DIVISION of General Motors has introduced a new variable wheelbase machine designated the Model S-18 with an Easton Car & Construction semi-trailer. S-18 is powered by a GM 6-110 336-hp engine with an Allison four-speed Torqmatic drive. Top speed is 25 mph with full payload. Struck capacity is 23 cu yd (heaped is 26).



Bit Sharpener (3)

SELF-CONTAINED unit designed for sharpening large drill bits with controlled grinding wheel movement to finish all surfaces accurately has been introduced by Gardner-Denver Co. The G6 bit grinder is designed to sharpen the larger bits with G-D 600, 700 and 1000 series thread and the Mole-Dril bits, but it will also take Timken A, D, and K sizes. Either cross or chisel face types can be ground.



One-Use Carbide Bits (4)

THROW-AWAY carbide insert drill bits—sizes 1⅜, 1½ and 1⅝ in.—are available from Le Roi Div., Westinghouse Air Brake Co., for use with any stoper, air leg or hand sinker drill that uses the dust collecting principle. Bits are cross type, five-hole design and fit ⅞-in. steel.

Floating Fuel Tank (5)

DEEP IN the South American jungle, 3,000 miles from the sea, a rubber-coated nylon bag is used to transport diesel fuel down the Coroico and Kaka Rivers in Bolivia. Manufactured by The Firestone Tire & Rubber Co., the 1,000-gal capacity Whale is known as Fabritank and was originally designed for storage, not the transportation of liquids. South American Placers, Inc., currently dredging gold in one of the most inaccessible sections of the Amazon drainage area on the eastern slopes of the Andes, has adapted the Fabritank to cut fuel transportation

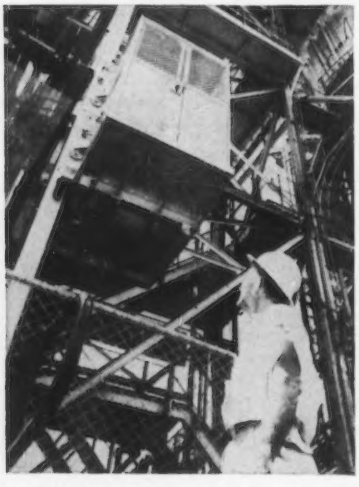
costs 80%. Diesel fuel is pumped from tank truck or storage tanks into the Fabritank, which is first placed in the river. Although the tank is filled to capacity, the diesel fuel is lighter than water and the tank floats well in the water.

After it has been filled, the tank is turned loose in the river and two Bolivians on a balsa raft accompany it downstream. There are many rapids and the water is rough, so the tank frequently rolls and occasionally is caught on the rocks. But the 37 miles to its destination are usually negotiated in about seven hours.

When the tank reaches its destination, it is lifted from the river by a truck crane using two wide straps made from conveyor belting. The Fabritank is then placed on a flat bed truck and hauled to the storage area, where it is emptied, rolled up and sent back by plane for another load.

John E. Lusney, field manager, explained that a more efficient method of unloading is being considered and present methods are only temporary. "We eventually will install a pumping device to empty the tank without removing it from the river," he said.

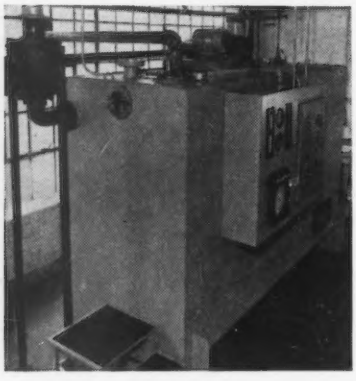
He explained that the company's dredging operations are in such a remote spot that the only alternative to the unique Fabritank of transporting fuel would be via expensive air lift. Consequently a vast savings is incurred.



Portable Elevator (14)

A PORTABLE personnel elevator with traction drive has been introduced by the Hawkeye Products Corp. The drive, unlike conventional drives, does not require a counterweight or other type of dead weight suspended on the cable to maintain driving friction. The advantage of the traction drive over the drum winding type is the elimination of the cable equalizing problems which arise on heights of 250 ft or more in drum winding equipment. The elevator operating on a vertical monorail, made up of 10 ft sections of "H" beam, has a carrying capacity of eight men or 2,000 lb. The traction equipment consists of a pair of driving drums at the bottom of the monorail column. The second drum is independently adjustable in order to facilitate alignment and equalization. Cable tension is maintained by a system of high tensile strength, stainless steel compression springs which are located on the car and are adjusted to give equal cable tension.

SINGLE stick control of the John Deere tractor is now available as optional equipment with the Pilot-Touch system that controls all movements. **(30)**

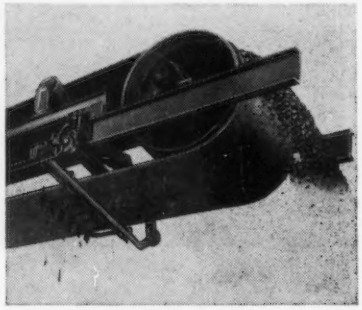


Sewage Disposal (31)

A PACKAGE disposal system providing complete biological treatment of marine or mining sewage has been developed by American Ship Building Co. The standard Biogest system has been designed especially for use on shipboard and in underground mines, and can be adapted for use in any situation where compactness and completely automatic operation are desirable. Standard sized units are available to handle all normal requirements. The completely automatic Biogest system makes use of aerobic bacteria. Fine bubble aeration is delivered by an air compressor through aeration heads. Thought to be the simplest ever devised for any complete treatment sewage disposal system, the unit must only be turned on during an operating season, and off when the system is secured during layup. Only simple lubrication and occasional maintenance of small motors in the pumping and aeration system are required. The odorless effluent from the system needs no supplementary treatment. It has been proved under a variety of test operating conditions to meet all existing or anticipated standards of the U.S. Public Health Service and other health authorities concerned with the discharge of waste in restricted waters. For underground mine use the system can be mounted on wheels and moved to new working areas periodically as required. The odorless effluent can be safely discharged into mine sump water which is continuously pumped to the surface, thus eliminating present methods of transporting waste.

Dust Sampler (32)

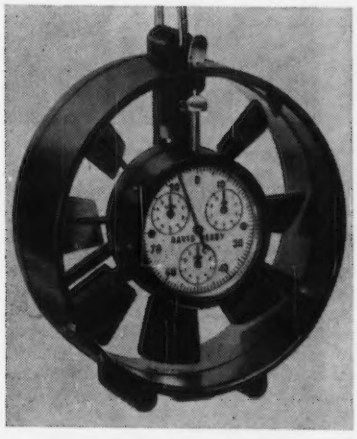
AN AIR SAMPLER called the Hurricane sampler has been developed by the Gelman Instrument Co. The high volume sampler collects dusts and aerosols on special filters which can be analysed to determine concentration of radioactive particles, toxic metals, dust contaminants and air pollutants. The sampler is powered by a motor driven turbine. A universal ½ hp motor with sealed ball bearings is used to drive the turbine. The sampler weighs 9 lb complete with 4-in. sampling head. The sampler can be used at rates of up to 100 cfm.



Spring Cleans Belt (33)

ORIGINALLY developed to clean wet, sticky coal and ore from high speed con-

veyor belts, the S-A spring type belt cleaner consists of a row of thin, spring steel wiper blades, each with an individual pressure spring. The wiper blades are set perpendicular to the belt surface, but diagonal to travel of belt. Pivoted connections between blades and springs permit wiping edges of blades to seat uniformly on the surface of the returning belt. As the belt passes over the cleaner, each blade wipes a path clean and dry. As blades overlap, the entire carrying surface is wiped clean and free from dirt and slime, according to Stephens-Adamson Mfg. Co.



To Measure Air Flow (34)

THE DAVIS ventilating flow instruments are intended chiefly for measuring air velocity in mine airways. Several models are available covering ranges from as low as 30 ft/min up to 6000. The instrument is of extra high accuracy, handy to use, light and precise. Several extension handles up to 5 ft are available as extra accessories. The instruments come either in a solid leather case or in a sturdy and light aluminum case, depending on the model, according to EPIC, Inc.

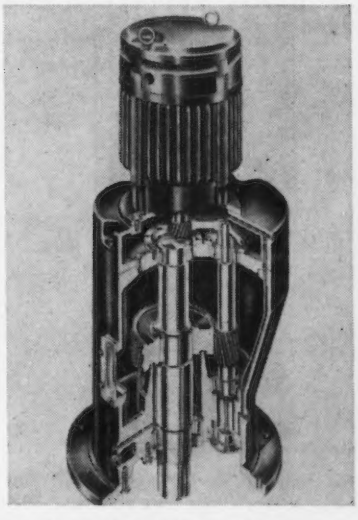
Blast Furnace Bosh (35)

BLAST FURNACE bosh plates are now available from Philadelphia Bronze & Brass Corp. in a double cooling chamber design that gives substantially longer life and reduced replacement labor cost. An outer chamber provides added protection for the nose of the bosh plate which is exposed to highest temperature. The chamber consists of 2-in. extra heavy high-conductivity copper pipe, which is cast directly into the copper bosh plate body by special PB & B techniques, to give maximum heat transfer and complete freedom from leaks. The inner chamber is made of high conductivity electrolytic copper, and can have cast-in baffles of any desired configuration. Inner and outer chambers have separate cooling water connections. Should either fail, the other can operate independently. The new bosh plates do not need dual piping, and can be installed in existing piping arrangements with only minor modifications.

Furnace Patching Brick (36)

A BASIC refractory patching brick for furnace roofs, recently patented by Lincoln A. McGill and Richard S. Moore of Harbison-Walker Refractories Co., may well become a most significant contribution to furnace maintenance, according to the company. Until now, basic roof patching was accomplished largely by securing the patch brick to tie rods or other supports in the furnace roof structure. This system, while basically sound, requires more time and is therefore more expensive than predicted for the new H-W side-attachment brick. Special basic shape patching brick involves a slot in the case and a recess in the brick directly underneath the slot, to permit the insertion of a support clip which engages the slot in the case to provide positive support to the shape. Patch bricks are supported by adjacent bricks rather than tie-rods. The clip can take on a variety of shapes. Special clips can be provided.

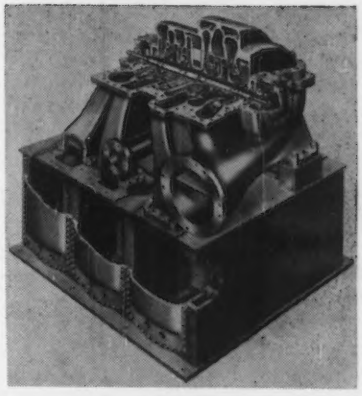
Allis-Chalmers Mfg. Co. has purchased an Italian firm—Vender, S. p. A, Cusano, Milan, Italy—that manufactures crawler tractors (60 to 325 hp) and spare parts.



Vertical Fluid Mixer (38)

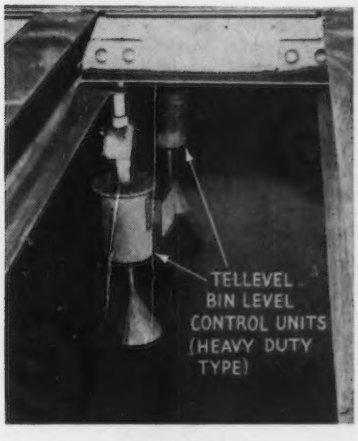
A MAJOR improvement in gear drives for vertical fluid mixers is announced by Philadelphia Gear Corp. The company's Philadelphia mixers are now available with gear drives having case hardened, precision-ground gears for greater load-carrying capacity and longer life, with reduced sound level and vibration. Philadelphia vertical fluid mixers are made in standard models ranging from 1 to 200 hp and special models up to 500 hp. Mechanical seals or packed stuffing box may be specified and paddle or turbine-type impellers.

General Mills, Inc. has acquired Magnaflux Corp., pioneer in the development of techniques and equipment for the detection of hidden flaws in industrial materials.



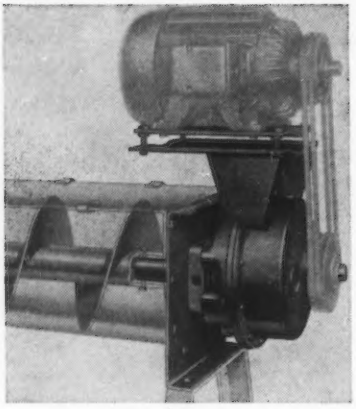
Multistage Compressor (37)

A HIGH EFFICIENCY, multi-stage centrifugal air compressor, designed to furnish 100 lb air for oxygen plants, centralized air systems and other industrial air applications has been introduced by Clark Bros. Co. Designated the Clark H line, the series features integral intercoolers between each stage of compression for highest possible efficiency. Six case sizes are available with horsepowers ranging from 1000 to 8000 bhp and capacities from 5000 to 38,000 cfm. Each unit is furnished as a complete package including matching driver, intercoolers and lubricating system.



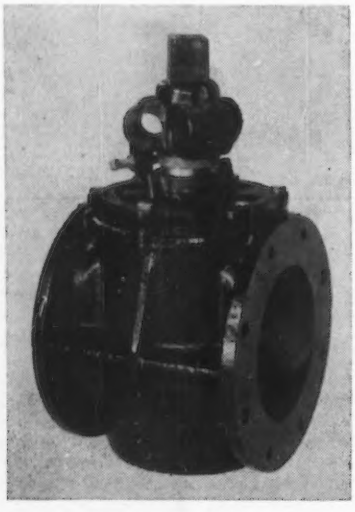
Bin Level Controls (41)

STEPHENS-ADAMSON have developed three styles of Tellevel bin controls to automatically control the level of material in bins. The three Tellevel bin controls included normal duty, explosion-proof and heavy duty. Each control is a self contained unit with a pendant float, which operates a sensitive enclosed switch. The units are mounted in bins or tanks to regulate level of bulk materials. As the material level rises or falls, the Tellevel will stop or start feed conveyors or elevators. The units can be installed to operate warning lights or horns. Automatic control or signals systems can be arranged by installing one or more controls near the top, bottom, or at various levels in a bin or tank.



Screw Conveyor Drive (42)

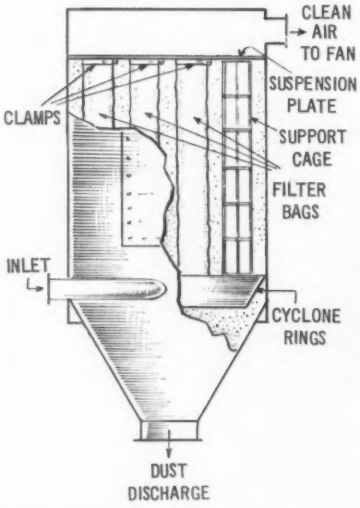
A HELICAL gear drive, designed for screw conveyor installations, has been announced by Falk Corp. Various drive assemblies can be furnished from stock. The basic drive (reducer with drive shaft and seal housing) can be combined with standard trough end as well as with the unique new Falk Motor Mount. Falk screw conveyor drives are manufactured in six sizes, each with ratios of 4:1, 9:1, 14:1, and 24:1, assuring correct selections for all conveyors requiring ½ to 30 hp. Drive shafts are removable, by means of a quick snap ring arrangement, on many applications, drive shafts can be removed without disturbing reducer or screw. Tapered roller bearings in unit absorb thrust from the screw conveyor, thus eliminating need for thrust bearing on trough end. Trough ends, available in eight sizes, from 6 to 20 in., bolt to any standard trough. Choice of seals (waste packing, felt seal, or lip seal, either leather or neoprene) is offered between conveyor and reducer, to suit the conveyed material.



Plastic-Coated Valves (43)

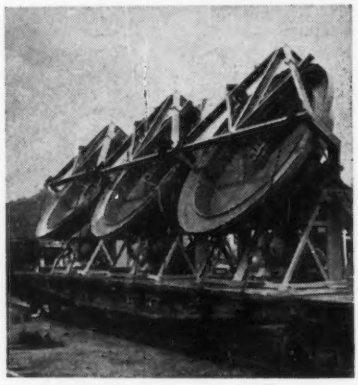
DEZURIK Eccentric valves are now available with plastic coatings. The coatings greatly improve the corrosion resistance of a cast iron valve at only a slight increase in price, the company stated. The plastic coatings make the valve especially suitable for neutral salt solutions, alkalies, alkaline salts, mild acids and many other services. They are said to be an economical answer to iron contamination in water distillation, demineralization and deionization systems. DeZurik valves work on a unique eccentric principle which pivots the plug eccentrically in the valve body to match an eccentrically-raised seat. The plug touches the valve body only when the valve is closed. Plug friction is completely eliminated. Their resilient faced plug eliminates the need for lubrication to achieve tight shut off.

A group of present and past employees of Oak Ridge National Laboratories has formed a company—Chemical Separations Corp.—to handle the sales and construction of the Higgins continuous ion exchanger contactor. Address is P. O. Box 149, Oak Ridge, Tenn.



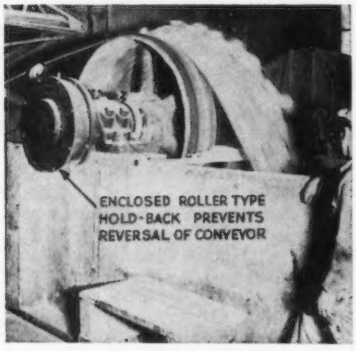
Baghouse Collector (39)

NO MOVING PARTS, constant air flow and pressure drop; plus automatic filter tube cleaning are said to be among the principal features of the dust collector announced by Flex-Kleen Corp. Being cylindrical, the new dust collector has no corners to harbor dust and require attention. In operation the unit receives dust-laden air through a tangential cyclone ring, and heavier materials are immediately dropped, thus preventing overloading of the filter tubes, the announcement states. The lighter materials are collected on the outside of the filter tubes. As the accumulation builds up, the tubes are intermittently flexed taut by sharp bursts of compressed air in a continuous series of sequences. This shake-off action, which can be adjusted as to duration and interval, cleanses the filter tubes constantly throughout operation, it is said. Filter cloth life is consequently prolonged, manual attention is reduced, and efficient operation of the unit is assured. It is compact in design, simple to install, and available in six sizes with 2,000 to 12,000 cfm.



Pelletizers For St. Joe (40)

THREE MIXING and pelletizing disks recently were shipped by Dravo Corp. to St. Joseph Lead Co., Monaca, Pa. The 8-ft 6-in. dia disks will prepare a mixture of roasted zinc concentrates, fines, flue dust and coke breeze for agglomeration on the Monaca plant's sinter machines. Each disk will turn out about 25 tons of mix per hour. After sintering, the material will be charged to electric zinc furnaces for reduction.



Conveyor Holdbacks (44)

STEPHENS-ADAMSON have developed two types of holdbacks—a standard roller-type and a totally enclosed-type specifically designed to protect personnel and equipment from dangerous reversal of conveyors and elevators. The S-A standard roller-type is a simple, rugged unit designed to give positive protection to bucket elevators and inclined conveyors. With the installation of a holdback on the head shaft, a conveyor or elevator can be stopped at any time without the danger of the load traveling backward. The roller-type is available in bore sizes 1 7/16 to 8 in. and is stocked for immediate delivery. The totally enclosed-type features a cast steel housing hardened wedge block and hardened steel rollers. This type has been very successful in protecting inclined conveyors and bucket elevators against accidental reversal. If power fails and the shaft tends to reverse, the rollers engage instantly.

For Your Files

This selected manufacturer's literature is free unless otherwise specified. If item is for sale, send request and money direct to manufacturer.

EXPANSION shells and plugs for roof-bolting from Ohio Brass Co., are discussed in an illustrated four-page bulletin (4947-M). **(60)**

DRILLS for horizontal, vertical and angular drilling powered by air, hydraulic, electric and gasoline for use in clay, sand gumbo, frozen ground, shale and limestone are detailed in a 12-page bulletin (633) on Ka-Mo products from The Ka-Mo Tools Dept., Kwik-Mix Co. **(61)**

PORTABLE and power cable for the mining industry from General Electric Co. are presented in a 15-page booklet (WC-8099). Both 600 volt and high voltage cables are included for underground or surface mine use. **(62)**

HOW one operator can batch and mix up to 150 tph of concrete is the subject of a four-page bulletin (ER-327-1) published by the Fuller Co. which features automatic weighing and proportioning and pneumatic conveying. **(63)**

DURA-ROLLER—International Harvester's 1000-hour lube interval track roller—is introduced in a four-page bulletin (CR-778-1). **(64)**

SPECIFICATION bulletins describing Model 134 and 164 Trojan Tractor shovels are available from Yale & Towne Mfg. Co. **(65)**

EIMCO 126 front-end loader is featured in a new brochure published by Eimco Corp. The 126 has 205-hp diesel engine. Bulletin L-1092. **(66)**

CATALOG (40-A) on the Bay City Series 40 states that, as an erector crane, the machine is available as a 20-ton crawler crane, 25- to 30-ton truck-mounted CraneMobile, or a 25-ton self-propelled CraneWagon; and as a ¾-cu yd crawler, the machine can be used as a crane, dragline, clamshell, shovel or hoe. 20pp. **(67)**

USE of the Eimco Corp. 105 Excavator on three recent U.S. tunnelling jobs is the subject of a 10-page bulletin (L-1091). **(68)**

STEP-BY-STEP explanation of how the SynchroTouch transmission control operates is given in eight-page bulletins on the 345-hp Caterpillar Tractor Co.'s DW20 and DW21 Series G tractors. **(69)**

PORTABLE transit-mix plant able to weigh out up to 70 cu yd of aggregate and cement an hour is described in a bulletin (KJ-658) from the C. S. Johnson Co. 4pp. **(70)**

AS A STANDARD crawler shovel, Baldwin-Lima-Hamilton Corp.'s Lima Type 1800 is equipped with a 35-ft boom and 5-cu yd dipper. As a crane, it can lift 112 tons. As a dragline, its capacity is variable according to literature available. **(71)**

ACKER PRESIDENT—Acker Drill Co.'s newest core drill—has a capacity of 4500 ft on AX (2-in.) bits according to literature now available. 6pp. **(72)**

ENGINEERING and services (and equipment) available from Nichols Engineering & Research Corp. are discussed in literature available. Nichols makes dryers, roasters, classifiers and furnaces. **(73)**

CONTROL dust, fume and mist with the ARCO jet gas scrubber systems is the title of a four-page bulletin on Process Equipment Div., Automotive Rubber Co., Inc.'s cyclonic jet and jet impactor scrubbers. **(74)**

CHEMICO GAS scrubbers for industry are illustrated in a 12-page bulletin from Chemical Construction Corp. Chemico makes a venturi and a cyclonic type. **(75)**

FOR WET OR DRY, fine or coarse, heavy or light screening of a wide variety of materials, the De Laval Syncromatic separator has many advantages according to literature available. **(96)**

DRUM FILTERS and pumps in the Komline-Sanderson Engineering Corp. line are presented in an 11-page bulletin (KSI-3). **(76)**

A STUDY OF GRINDING-BALL wear employing a radioactive tracer technique, a paper by A. L. Wesner, M. Pobereskin and J. E. Campbell (which was presented at the 1958 AIME) is available from Coates Steel Products Co. Illustrated in 11 pp. **(77)**

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BULLETIN from Stein, Hall & Co., Inc. on the properties of Jaguar®—a flotation reagent and filtering aid—contains much more data than the earlier publication (1956). 15pp. **(78)**

CONTINUOUS belt drum filter—the Eimco Corp. Eimcobelt—is illustrated and discussed in a 10-page bulletin (F-2053). **(79)**

ELECTRIC SCREENS in the W. S. Tyler Co. Hum-mer line are presented in a 20-page catalog (83) from the company. **(80)**

DIMETCOTE NO. 3—an inorganic zinc coating for cold galvanizing any steel surface is introduced in a four-page bulletin from Amercoat Corp. **(81)**

LOGWASHER for tough clays, soft rock and other materials is available from McLanahan & Stone Corp. according to a six-page bulletin (90) on the Mudmaster line. **(82)**

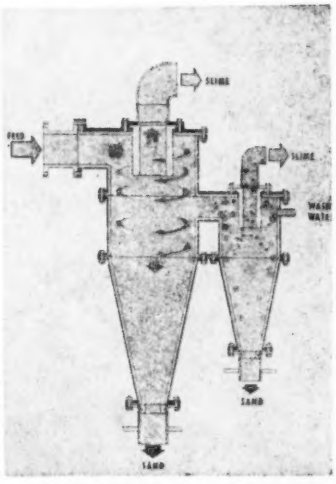
CATALOG guide of Allis-Chalmers Mfg. Co. line of process equipment is available on request. (25C6177P). Disintegrating, mixing, agglomerating, fluid flow, dry separation, liquid separation, material handling, electrical equipment and water conditioning equipment are covered. Illustrated in 32 pp. **(83)**

HEAVY-DUTY hammer mills and accessory equipment in the Williams Patent Crusher & Pulverizer Co., Inc. line are presented in a 27-page bulletin. **(84)**

EQUIPMENT, processes and services available from De Laval Separator Co. are illustrated in an eight-page bulletin. De Laval makes centrifuges, clarifiers, screens and heat exchangers. **(85)**

WET CAKE filter developed by Read Standard called the automatic Short-Cycle wet cake filter is discussed on a two-page flier. Wet Cake unit has moving cloth and large capacity potential despite the small size of the unit.—1.6 sq ft cloth area and 100 lb/hr dry cake discharge rate. **(86)**

ABRASIVE SLURRY VALVE described in United Conveyor Corp.'s Bulletin 159-A can be installed in any position, has no slots or guides to interfere with valve movement. Pipe sizes from 4 to 10 in. are available. **(87)**



IN THE PAST few months, Denver Equipment Co. has joined the ranks of the wet cyclone manufacturers with their Denver-Morton duplex cyclone classifier. Six sizes are available—24x18", 18x12", 12x8", 8x6", 6x4½", 4½x3⅜-in. dia according to a four-page bulletin. Denver-Morton design employs a wash water inlet on the second cyclone (see drawing above). **(88)**

LABORATORY wet cyclone test set—the Liquid-Solid Separations Ltd. Mark III Hydrocyclone—contains both 15 and 30 mm glass cyclones fitted with conical inlet joints that permit the cyclones to be joined to pumps and feel tanks. Set has capacity range of from ¼ to 4 gpm and can make cuts down to 5 microns. Liquid-Solid Separations Ltd. is also interested in finding a U.S. firm to handle the set in the U.S. Literature available. **(89)**

WIRE cloth and filter cloth in the lines carried by Multi-Metal Wire Cloth Co., Inc. are presented on a two-page flier. Many types of metal, weave, and custom fabrications are available. **(90)**

BIN DISCHARGER patented by Pulva Corp. is illustrated in a six-page catalog bulletin (5910) for bins or silos having 2-, 4-, 6-, 8- and 10-ft dia bottom openings. **(91)**

Annual Index

E&MJ's annual index for 1959 in reprinted form is available free of charge upon request to the Reprint Editor, ENGINEERING & MINING JOURNAL, 330 West 42nd St., New York 36, N.Y.

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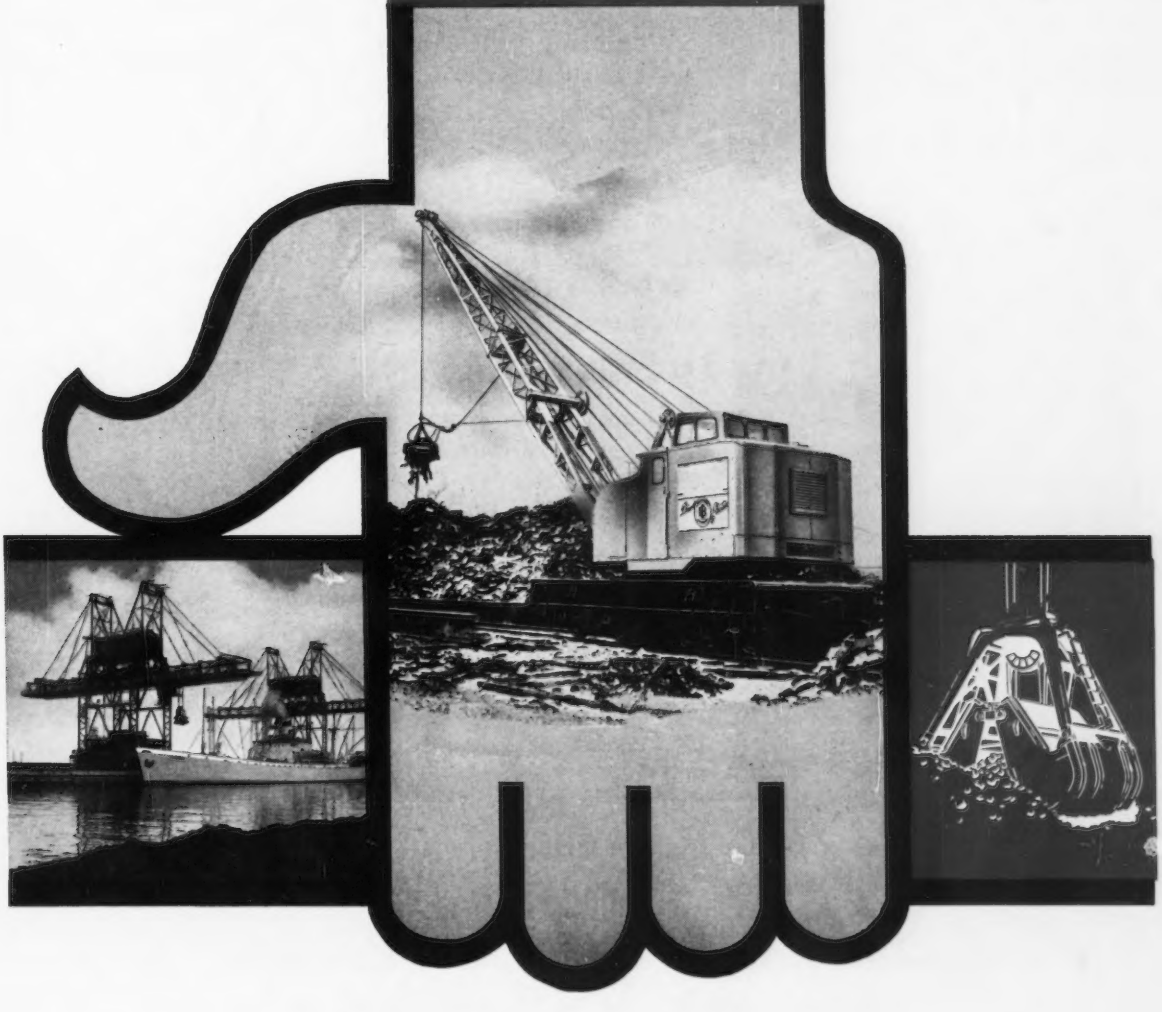

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cranes, bridges, towers and buckets

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NAYLOR Spiralweld pipe is easy to handle and install.

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Its distinctive spiral-lock-seam structure provides a lightweight pipe without sacrifice of strength and safety.

★

Lines are made up faster when you make connections with NAYLOR Wedgelock couplings.

★

For handling air, water, tailings or for ventilating lines, it will pay you to look into the NAYLOR pipe and coupling combination.

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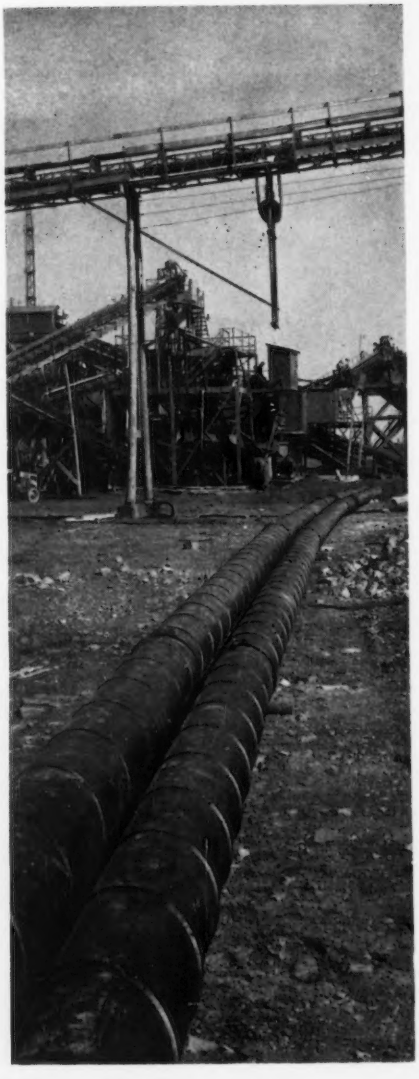

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Eastern U. S. and Foreign Sales Office: 60 East 42nd Street, New York 17, N. Y.

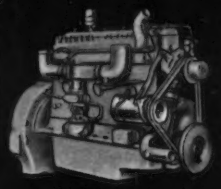
CARBURETED

U-1091
248 max. hp. (nat. gas)

UV-549
222 max. hp.

UV-461
179 max. hp.

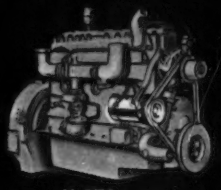
UV-401
170 max. hp.



U-501
141 max. hp.

U-450
134.5 max. hp.

UB-264
112 max. hp.



U-372
110 max. hp.

UC-263
95 max. hp.

U-308
92 max. hp.

UB-220
83 max. hp.

UC-221
75 max. hp.

UC-135
42 max. hp.

UC-60
16.5 max. hp.

Specify International and be sure your mine engines have

fastest payback power!

You can be sure of fast payback power in your mining machines when these machines are powered by heavy-duty International engines.

International engineers with over 50 years of heavy-duty engine design experience have made fastest payback power the one common feature of all these engines through lowest cost operation, long-working stamina, thorough sealing, and minimum maintenance.

And it's easy to match International power exactly to your mining machines without overpowering or underpowering. Choose from 24 models ranging from 16.5 to 385 max. hp. Choose from diesels or natural gas, LPG and gasoline carbureted in 4's, 6's, or V-8's.

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Discover how fastest payback power can lower your mining costs by contacting your International Power Unit Distributor or Dealer.

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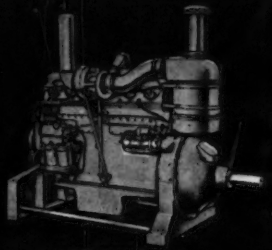
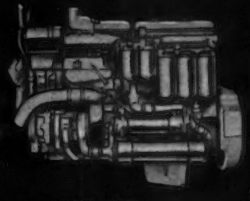
DIESEL

UDT-817
385 max. hp



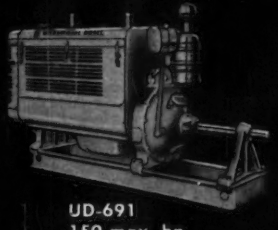
UDT-1091
300 max. hp



UD-817
250 max. hp

UD-1091
224 max. hp

UD-554
150 max. hp



UD-691
150 max. hp

UD-14A
105 max. hp

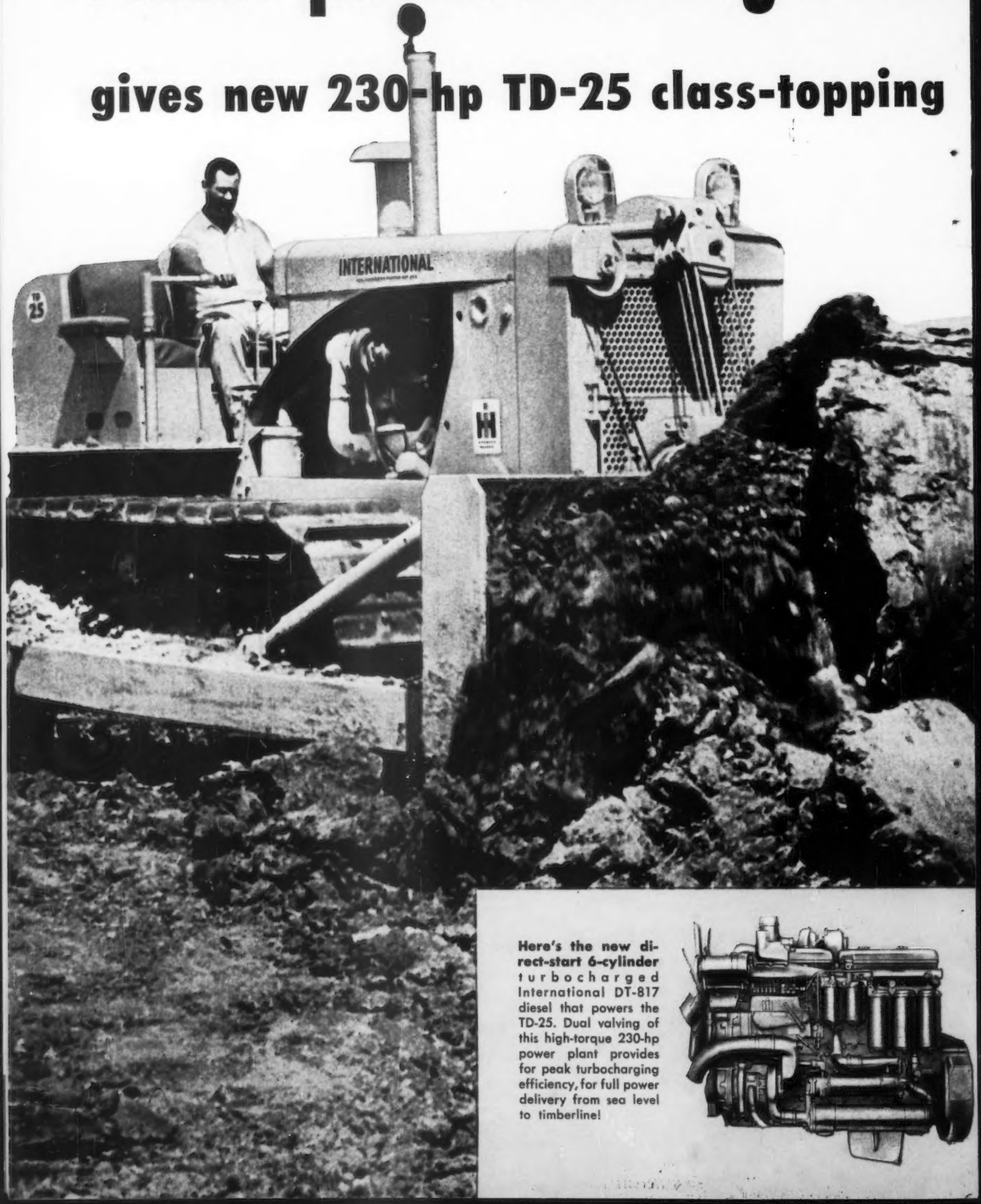
UD-370
105 max. hp

UD-282
95 max. hp

UD-236
75 max. hp

Planet power steering with

gives new 230-hp TD-25 class-topping



Here's the new direct-start 6-cylinder turbocharged International DT-817 diesel that powers the TD-25. Dual valving of this high-torque 230-hp power plant provides for peak turbocharging efficiency, for full power delivery from sea level to timberline!

built-in power-shifting

capacity!

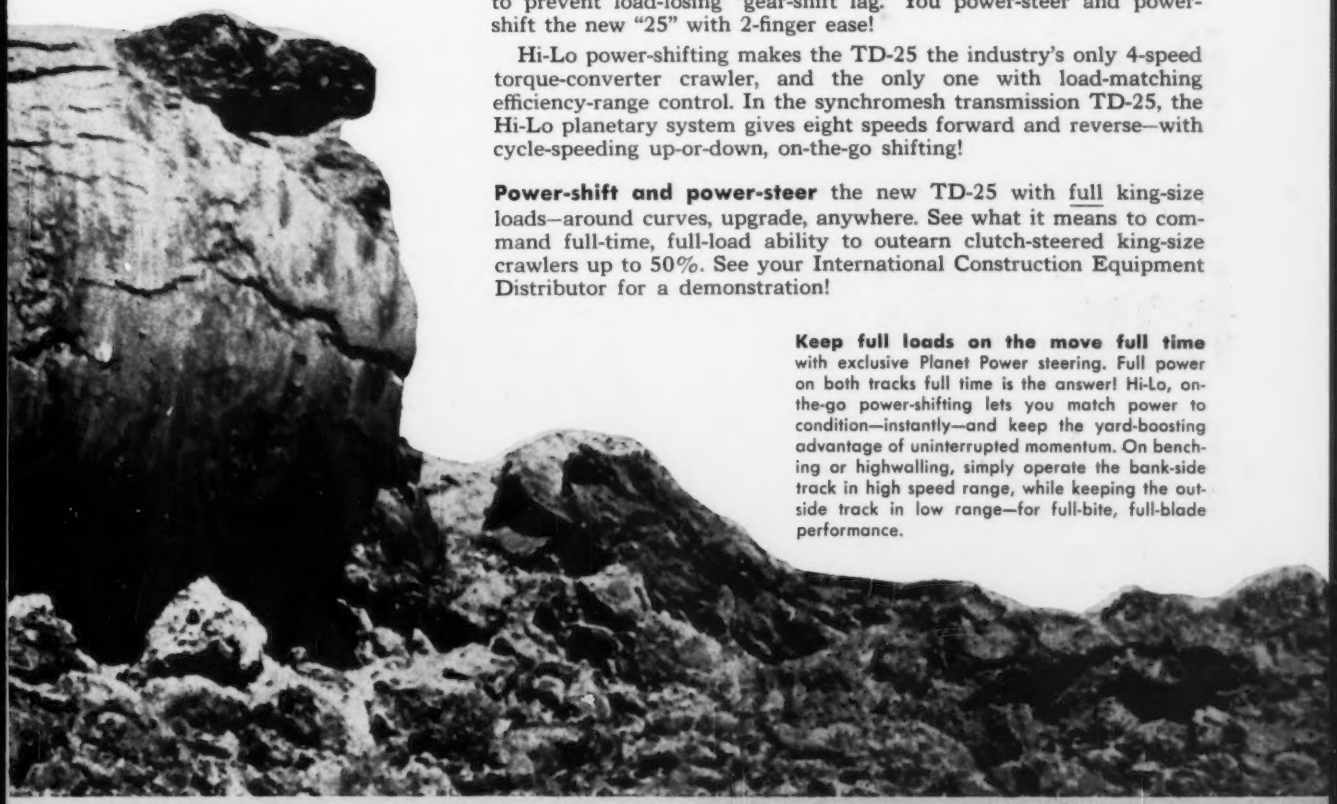
You get combined Planet Power-steering and Hi-Lo on-the-go power shifting exclusively in the new International TD-25 crawler. As standard equipment at no extra cost, the TD-25 gives you the International-developed control combination that has been beating the daylights out of king-sized clutch-steered crawlers for years!

With this and all its other big advantages, the TD-25 can outearn other big rigs up to 50%—on highwalling, benching and side-casting, as well as on straight dozing to remove overburden, or to harvest minerals or building materials!

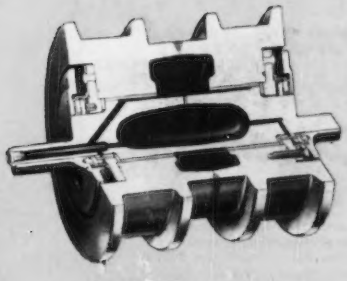
No "dead-track drag" or "gear-shift lag"! Planet Power steering gives you full-time "live" power and traction on both tracks to make full-load turns—and eliminate load-limiting dead-track drag. And Hi-Lo on-the-go power shifting instantly matches power to condition to prevent load-losing "gear-shift lag." You power-steer and power-shift the new "25" with 2-finger ease!

Hi-Lo power-shifting makes the TD-25 the industry's only 4-speed torque-converter crawler, and the only one with load-matching efficiency-range control. In the synchromesh transmission TD-25, the Hi-Lo planetary system gives eight speeds forward and reverse—with cycle-speeding up-or-down, on-the-go shifting!

Power-shift and power-steer the new TD-25 with full king-size loads—around curves, upgrade, anywhere. See what it means to command full-time, full-load ability to outearn clutch-steered king-size crawlers up to 50%. See your International Construction Equipment Distributor for a demonstration!



Keep full loads on the move full time with exclusive Planet Power steering. Full power on both tracks full time is the answer! Hi-Lo, on-the-go power-shifting lets you match power to condition—instantly—and keep the yard-boosting advantage of uninterrupted momentum. On benching or highwalling, simply operate the bank-side track in high speed range, while keeping the outside track in low range—for full-bite, full-blade performance.



Thickest-shelled roller design in the crawler industry — with king-size lube reservoirs and seal-protecting pressure-relief passages —combine to make TD-25 Dura Rollers the ones you can power-lubricate without affecting seal life or efficiency!

International® Construction Equipment

International Harvester Co., 180 North Michigan Ave., Chicago 1, Illinois

A COMPLETE POWER PACKAGE: Crawler and Wheel Tractors . . . Self-Propelled Scrapers and Bottom Dump Wagons . . . Crawler and Rubber-Tired Loaders . . . Off-Highway Haulers . . . Diesel and Carbureted Engines . . . Motor Trucks . . . Farm Tractors and Equipment.

Now "trade" dead weight for payload..and haul 40% faster!

Heap-load the big-target Payhauler body in minimum time. Strong rock-ribbed corrugations absorb shock—resist wear and distortion. Choose the "95" with power-shift Torque-Converter, or 9-speed air-shift transmission.

New strength-multiplying corrugated body design results in payload-gaining weight reduction of both International Payhauler models. New "95" capacity is increased to 27 tons—and the new "65" becomes the only 19-tonner on the market!

Look at those exclusive, rock-ribbed body corrugations! International applies this strength-multiplying principle to reduce Payhauler® body weight by an amazing 30%! You "trade" 2½ tons of power-wasting dead weight for 3 bonus tons of payload capacity in the new 95 Payhauler!

New high-torque, high-output diesel power highballs 27-ton payloads up to 40% faster than the former "95" could haul only 24 tons! The new 375 hp DT-817 International diesel engine gives the new 95 Payhauler the wallop of 40 extra turbocharged "horses."

Prove to yourself that top load-carrying capacity plus top power-to-weight ratio give 95 Payhaulers tremendous profit-earning advantages. Add up other big Payhauler exclusives: fast reverse, up to 7.1 mph. for spotting speed; big-target bodies for loading zip; 11-second inverted-hoist dumping; load speeding safety of torqmatic braking and positive power-steering! Let your International Construction Equipment Distributor demonstrate!

International® Construction Equipment

International Harvester Co., 180 N. Michigan Ave., Chicago 1

A COMPLETE POWER PACKAGE: Crawler and Wheel Tractors . . . Self-Propelled Scrapers and Bottom-Dump Wagons . . . Crawler and Rubber-Tired Loaders . . . Off-Highway Haulers . . . Diesel and Carbureted Engines . . . Motor Trucks . . . Farm Tractors and Equipment.

"I call Bethlehem when I need track spikes fast. They carry all standard sizes in stock, ready to go at a moment's notice."

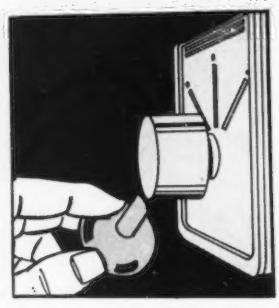
BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

Superior crusher with Hydroset mechanism

Plan to stay ahead... MODERNIZE!



. . . for balanced circuit or constant tonnage

It's no problem to maintain a smooth, high-capacity flow through the plant when you head your circuit with a *Superior* primary crusher. The exclusive *Hydroset* mechanism in the *Superior* crusher maintains the initial setting and a uniform product by compensating for wear on mantle and concave with just the flip of a switch. This means other equipment in the circuit does not require readjustment to meet variations in material size. Result—constant tonnage, higher plant efficiency with lower operating costs.

If a *Superior* primary or secondary crusher stops under load, *Hydroset* mechanism lowers the mainshaft in seconds to help clear the chamber. Changing crusher settings is a flip of the switch operation, too. Only Allis-Chalmers crushers offer the speed and convenience of a hydraulically controlled mainshaft.

Bulletin 07B7870 will give you all the details. Ask your A-C representative for a copy, or write Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin.

A-C ALLIS-CHALMERS A-5605

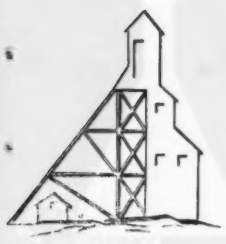
ALLIS-CHALMERS

Superior and *Hydroset* are Allis-Chalmers trademarks.

CYANAMID

REAGENT NEWS

"ore-dressing ideas you can use"



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High Explosives
Permissibles
Seismograph Explosives
Blasting Agents
Blasting Caps
Electric Blasting Caps
Blasting Accessories

Recent plant tests reveal wider usefulness for new SUPERFLOC 16 Flocculant*

Prove it out-performs previous flocculants for variety of solid-liquid separations

URANIUM

0.003 to 0.10 lb./ton of SUPERFLOC 16 fed to the leach pulp improves settling and filtration rates; assures clearer thickener overflow. SUPERFLOC 16 Flocculant reduces soluble loss in thickened solids or filter cake, prevents sand-slime separation in the thickener, gives higher pulp density in the thickener underflow!

COAL

Less than 1 lb. per hour drip fed as a ½% solution clarifies up to 10,000 gal. per minute of wash water containing 3% solids, increases settling pond capacity, minimizes stream pollution, assures clear effluent or recycle water.

COPPER-MOLY

0.036 lb./ton SUPERFLOC 16 fed to MoS_2 thickener produces a clearer overflow and higher moly recovery than 0.048 lb./ton of other flocculant previously used.

NONMETALLIC MINERAL

Addition of 4 lb. SUPERFLOC 16 per day cuts loss of solids in thickener overflow by 92.2%. Values recovered are worth several hundred times the daily cost of SUPERFLOC used. Comparative tests show SUPERFLOC 16 is substantially better than other flocculants.

WRITE FOR THIS TECHNICAL BULLETIN

Write for technical bulletin giving complete data on SUPERFLOC 16 Flocculant and AEROFLOC® Reagents; working sample and instructions for conducting your own plant test.

*Trademark

AMERICAN CYANAMID COMPANY
EXPLOSIVES AND MINING CHEMICALS DEPARTMENT

CYANAMID INTERNATIONAL — *Mining Chemicals Department*
Cable Address: — Cyanamid, New York

30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

Contractor: West Delaware Tunnel Constructors; *Drill Steel Reconditioner:* New York Steel and Rock Bit Co.

Drill Steel Bores Blast Holes for New York's New Water Tunnel.

This photograph shows Bethlehem Hollow Drill Steel boring blast holes in Catskill Mountain sandstone, near the No. 6 Shaft of West Delaware Tunnel, at Livingston Manor, N. Y. Upon completion, the 11 ft, 4 in.-diameter tunnel, 44 miles long, will be an important new link in New York City's vast water supply system. West Delaware Tunnel Constructors, contractors for this phase of the project, used $1\frac{1}{4}$-in. round Bethlehem Hollow, fitted with carbide-insert bits. They reported good drilling progress, with minimum breakage. Bethlehem Hollow, in Carbon and Ultra-Alloy grades, is well known for its economy. That's why you'll find it in service in every kind of rock removal project.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA. *Export Distributor:* Bethlehem Steel Export Corporation

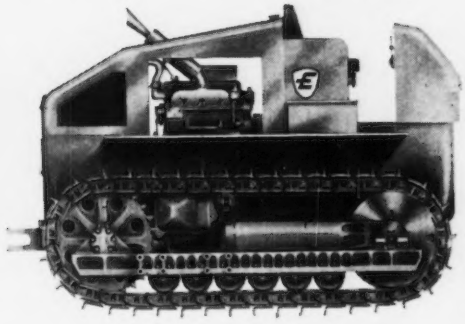
BETHLEHEM STEEL

BETHLEHEM STEEL

WE ASKED THE OWNERS AND OPERATORS,

"WHAT DO YOU WANT IN A BETTER TRACTOR?"

THEN WE ENGINEERED AND BUILT



THE EIMCO 103

You wanted maximum maneuverability in a medium size machine.

The Eimco 103 features independent track operation through Eimco's famous "Unidrive" and Dual Final Drives. True spin turns on its own length.

You wanted a choice of speed ranges.

Eimco engineered "Quadra-Torque", giving you a choice of four forward and four reverse speeds. You can shift from one to the other or from forward to reverse and back again at any tractor or engine speed by the flip of a lever, without slowing or stopping tractor. Gears never reverse rotation in Eimco's exclusive "Unidrive" transmission. Soundly engineered simplicity means less maintenance, longer life.

You wanted rugged construction, with minimum maintenance problems

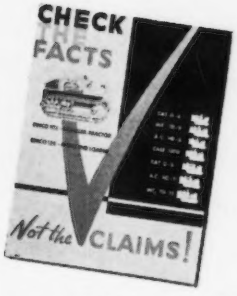
Unitized "Stress Flow" Construction is the answer, another Eimco exclusive. No bolts; no welds. Large, strong steel castings are molded to shape and thickness required for new, greater strength and rigidity. Main frame, final drive and center housing on Eimco 103 are all in one strong casting, as is track roller frame and diagonal brake assembly, yet components are still readily accessible!

You wanted reliable, proven power plants.

The Eimco 103 is powered by 100 HP General Motors or Cummins Diesels of latest, modern design and efficiency, teamed with single stage heavy-duty torque converter, for full utilization of power.

You wanted sufficient ground-clearance.

The Eimco 103 has full 17" ground-clearance, over 40% more than the average.



For all the facts on additional features, write for specifications and comparative Fact Brochure, listing vital statistics of all leading makes of tractors and front end loaders.

The Great 103 Series:
Eimco 103 Tractor and Dozers
123 Front End Loader
133 Special Steel Mill FEL
143 Log Loader

Address The Eimco Corporation, P.O. Box 300, Salt Lake City 10, Utah, U.S.A.

B - 460

"ADVANCED ENGINEERING AND QUALITY CRAFTSMANSHIP SINCE 1884"

THE EIMCO CORPORATION

EIMCO

TRACTOR LOADER DIVISION

634 SOUTH 4TH WEST
SALT LAKE CITY, UTAH — U.S.A.

EXPORT OFFICE: 51 - 52 SOUTH STREET, NEW YORK, N. Y.
BRANCHES AND DEALERS IN PRINCIPAL CITIES THROUGHOUT THE WORLD

Famous Traylor Gyratory Crushers are manufactured in sizes designed to solve most reducing problems. From the mighty 60" TC to the TF Fine Reduction Crusher—Traylor engineers supply the finest Gyratory obtainable.

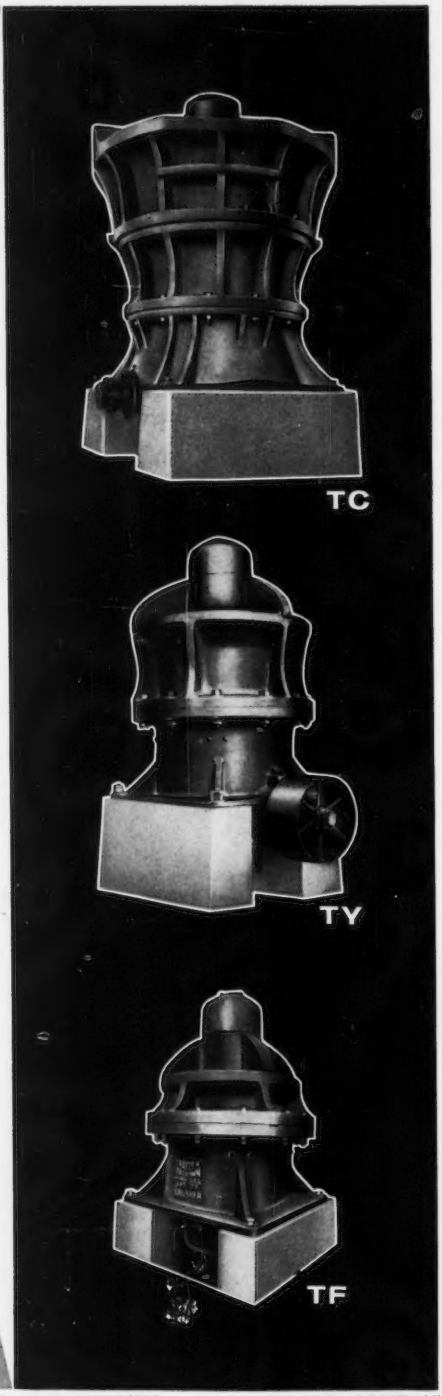
Traylor-made gyratory crushers

TC Gyratory Crushers are made in 7 sizes with feed openings 20" to 60" and capacities from 1,240 to over 32,000 tons per eight-hour day. For additional information, write for Traylor Bulletin No. 1126.

TY Reduction Crushers are built in 6 sizes from 1'—3" to 5'—6" and with feed openings from 3" to 22". For more information, write for Bulletin No. 8112.

Traylor TF Fine Reduction Crusher produces 3/16" to 1¼" material in large capacities. Over a half century of engineering experience is built into all Traylor crushing machinery. Write for Bulletin No. 127.

Visit us at Booth No. 56 at the CRUSHED STONE SHOW—Feb. 22 thru 24 Conrad Hilton, Chicago



Traylor

TRAYLOR ENGINEERING & MANUFACTURING *division of* **FULLER COMPANY**

1501 MILL ST., ALLENTOWN, PA.

Sales Offices: New York—Chicago—San Francisco

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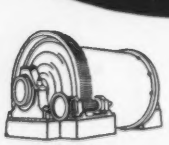
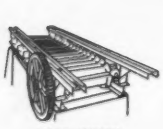
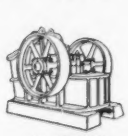
FULLER COMPANY GENERAL AMERICAN TRADE MARK


BALL MILLS

ROTARY KILNS


APRON FEEDERS

PRIMARY GYRATORY CRUSHERS


JAW CRUSHERS

SECONDARY GYRATORY CRUSHERS

No Blinding

Even Filtering the Most Difficult Slurries

EIMCOBELT
Continuous Belt Drum
FILTER

FILTER MEDIUM ALWAYS CLEAN . . . EimcoBelt filter's new operating principle removes the medium from the drum every filter cycle for cake discharge and cloth washing. No "time out" for cleaning is necessary.

HIGH CAPACITY — With no fall-off in filtration rate caused by progressive blinding, EimcoBelt filters operate at rated capacity at all times. Average production is from one-half to two times higher than average capacities on standard drum filters. Required tonnage can be obtained with a smaller filter.

SAVES TIME AND MAINTENANCE — Cloth filter medium on EimcoBelt filter can be changed by one man in less than 30 minutes. Cloth lasts longer because there's no air blow to billow cloth medium against scraper.

Send for EIMCOBELT Bulletin F-2053

THE EIMCO CORPORATION

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634 SOUTH 4TH WEST
SALT LAKE CITY, UTAH — U.S.A.

RESEARCH AND DEVELOPMENT CENTER
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Jumbo Components
Jumbo Carriages
"Air Trac"® Crawler Drills
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Carburized Drill Steel
Couplings
Ring Seal Shanks
Mine Car Loaders
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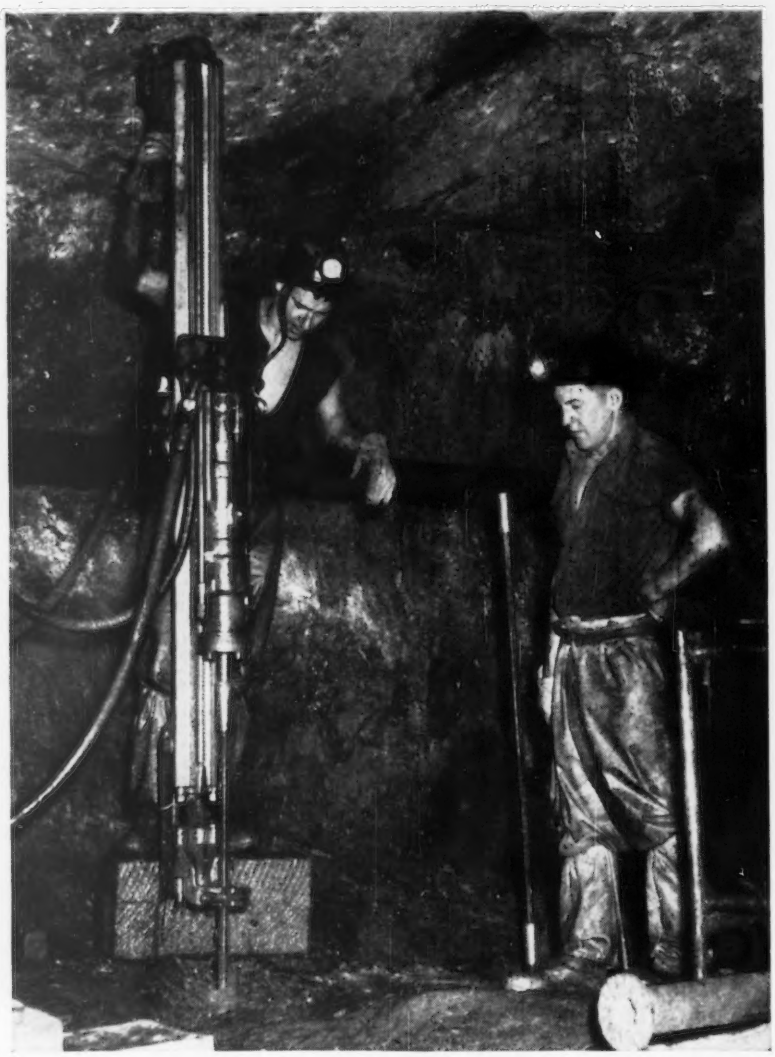
Stationary Compressors
Rotary Portable Compressors
Grout Pumps
Slurry Pumps
Dewatering Pumps
Impact Wrenches
Air Maintenance Tools
Air Hoists
Bit Grinders
Oil Forges
Air Line Oilers
Drill Steel Sharpeners



In step with modern mining needs —GARDNER-DENVER

Why is Gardner-Denver so often first choice in mining properties throughout the world? Over the years Gardner-Denver engineers and mining men have worked side by side. Their combined know-how, experience and resources have led to the development of equipment for use in every type of rock and ore—safer, more productive equipment that meets the need of modern mining in open pit and underground.

That's why—time and again—penetration rates go up and costs per foot of hole come down when Gardner-Denver drills and drill steel are used . . . why Gardner-Denver mine car loaders, drilling equipment, pumps and compressors are favorites among mining men everywhere.

At Gardner-Denver there's no substitute for men—our 100-year philosophy of growth. See your Gardner-Denver mining specialist soon.

EQUIPMENT TODAY FOR THE CHALLENGE OF TOMORROW

GARDNER - DENVER

Gardner-Denver Company, Quincy, Illinois
Export Division, 233 Broadway, New York 7, New York
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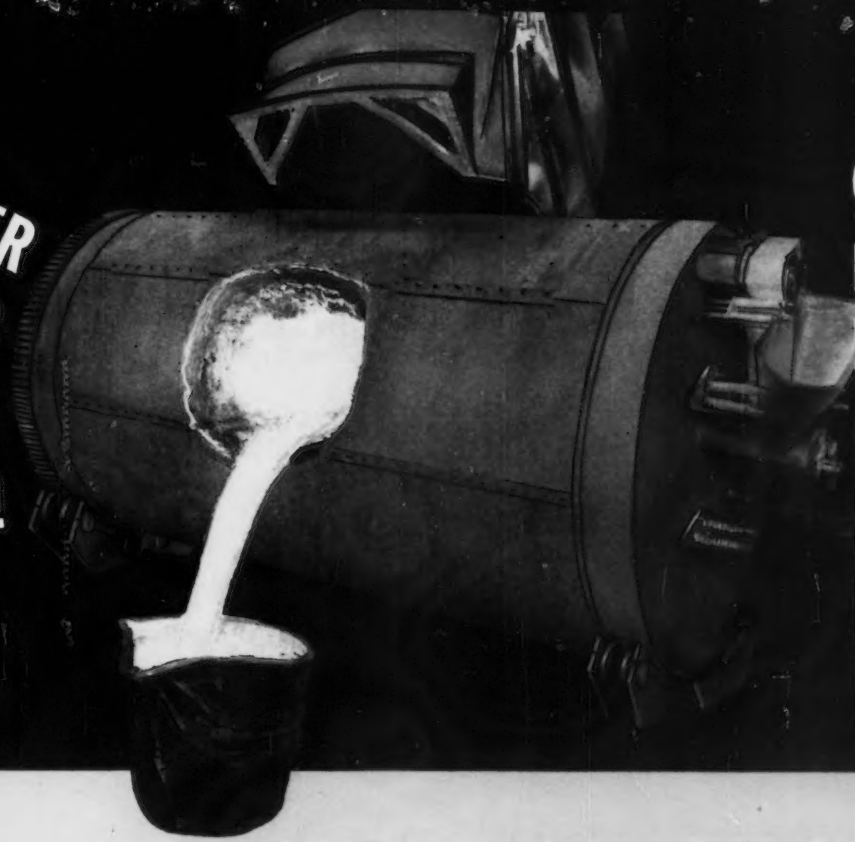
*Trade-Mark

CONVERTER NEEDS ARE BASIC!



GENERAL REFRACTORIES

● The world's foremost supplier of basic refractories is The General Refractories Company. For copper converters, two types of basic brick are recommended. Some converters no longer "magnetite" their linings. For such vessels, Grefco's RITEX CB brand burned chrome-magnesite brick give long, trouble-free life. For vessels which "magnetite", GREFCO M burned magnesite brick, made from superior Austrian magnesites, yield unmatched performance.

Other Grefco basic brick sometimes used in copper converter linings include RITEX C, RITEX 40 and PERATEX. These brands are sometimes preferred to meet special service conditions.

KROMEBOND, Grefco's chrome-magnesite air-setting mortar, has been preferred for many years as a superior bonding material for both types of linings.

Some operators prefer KROMESET bonding mortar, which takes a stronger air-set than KROMEBOND.

For your particular converter problems, call Grefco's experienced sales and service representatives.

GENERAL REFRACTORIES CO.
Philadelphia 2, Pa.

RITEX CB burned-chrome magnesite brick

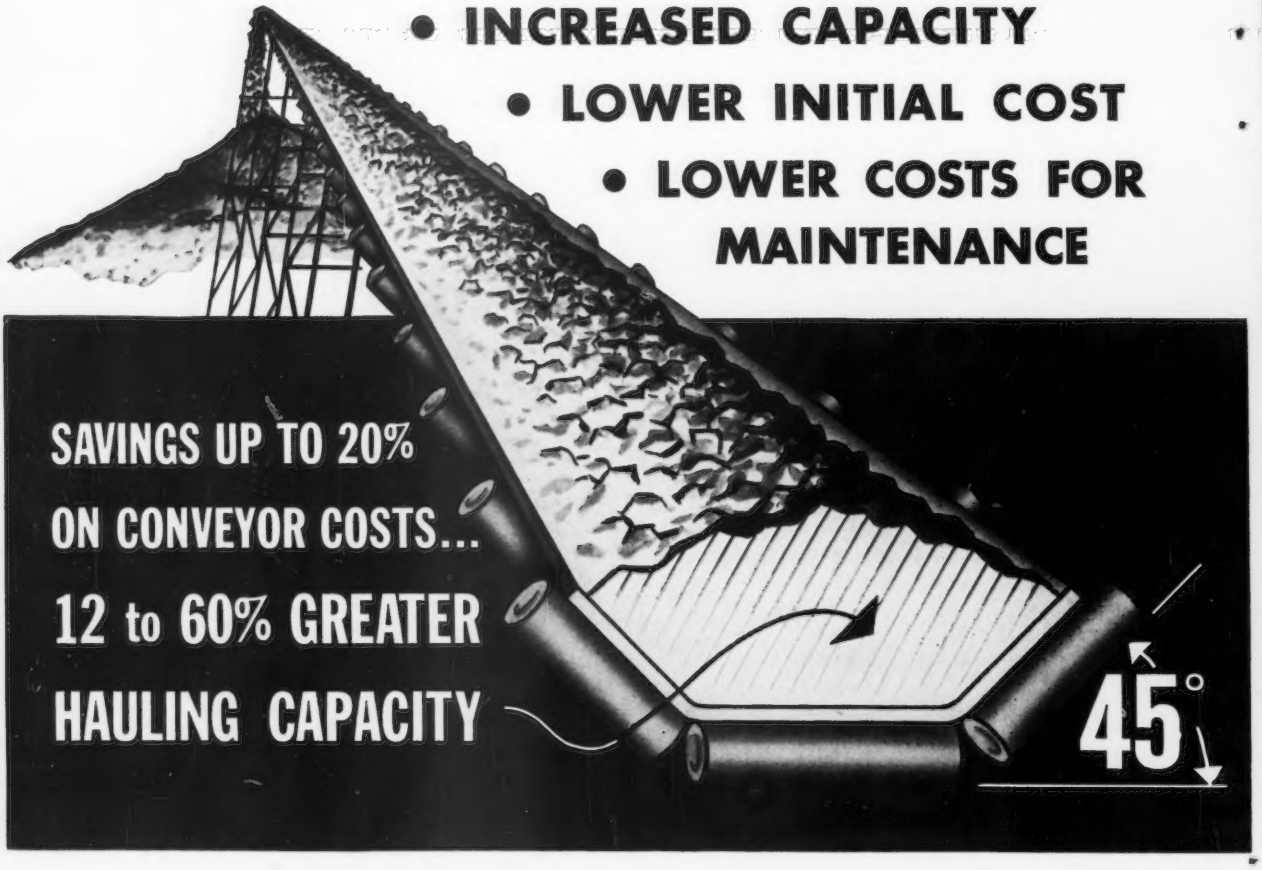
KROMEBOND air-setting chrome magnesite mortar

GREFCO M burned magnesite brick

MOST IMPORTANT NEWS

NOW YOU CAN USE 45° IDLERS

- INCREASED CAPACITY
- LOWER INITIAL COST
- LOWER COSTS FOR MAINTENANCE



It's a mathematical certainty that a belt can haul bigger loads with 45° idlers than with regular 20° idlers. But the 45° angle between concentrating idlers and bottom roll idlers is too sharp for an ordinary heavy duty conveyor belt. Plies separate, but modern RAY-MAN CONVEYOR BELT licks this problem . . . for all time!

Ray-Man's exclusive flexible construction and built-in stress compensation is guaranteed to take the sharp angle of 45° idlers without ply or cover separation at the hinge line. This opens a whole new era of conveyor design . . . permitting larger loads . . . narrower conveyors . . . assuring longer cover wear . . . lower handling costs!

RAY-MAN GIVES YOU "*MORE USE PER DOLLAR*" WITH 45° IDLERS

IN CONVEYING TODAY!

...TO HANDLE ALL MATERIALS

BIGGER LOADS, LESS SPILLAGE, LESS WEAR ON COVER WITH 45° IDLERS

20° IDLERS REQUIRE WIDER CONVEYOR TO HAUL SAME TONNAGE

Only RAY-MAN CONVEYOR BELT is BUILT to take the EXTRA STRESS OF 45° IDLERS

RAY-MAN IS GUARANTEED NOT TO PLY-SEPARATE AT 45° ANGLES

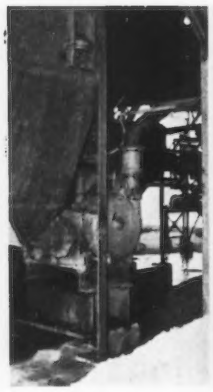
ORDINARY PLY BELTS ARE TOO BOARDY TO TAKE 45° ANGLES

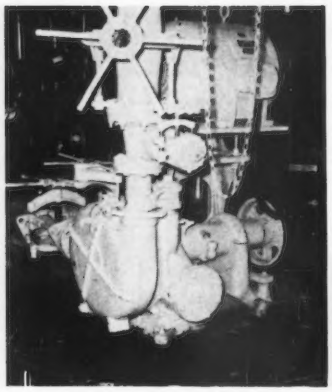
Ask your R/M representative to show you how Ray-Man Conveyor Belt with 45° idlers can give you the most for your conveyor dollar . . . write for new Bulletin M303, "Ray-Man for 45° Idlers."

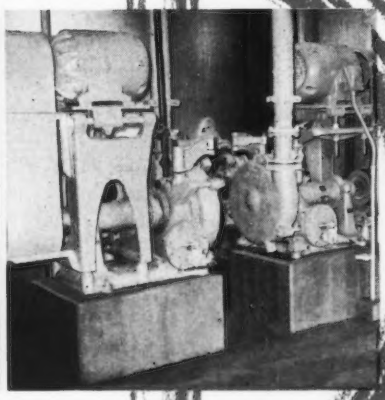
RAYBESTOS-MANHATTAN, INC.
MANHATTAN RUBBER DIVISION, PASSAIC, NEW JERSEY

RM

RM-861
ENGINEERED RUBBER PRODUCTS ... MORE USE PER DOLLAR







EVERY INSTALLATION

Job Engineered

FOR MAXIMUM

PUMPING ECONOMY

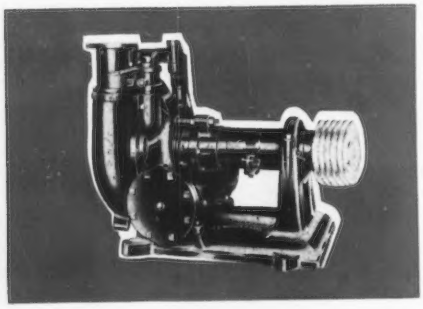
Individual engineering on every application is standard practice with Wilfley. This personal attention to your specific requirements, plus Wilfley's day-in, day-out dependabilty, guarantee low cost pumping. Put a Wilfley Sand Pump to work . . . it will give you continuous, maintenance-free service, higher output, longer pump life, and quick, easy replacement of parts.

Wilfley Sand Pumps may be fitted with interchangeable electric furnace alloy iron, special application alloys, or rubber-covered wear parts.

Write, wire or phone for complete details.

WILFLEY
SAND PUMPS

Wilfley Sand Pumps
"Companions in Economical Operation"
Wilfley Acid Pumps



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Let's Take a Fresh Look at the Gold Problem

A FEW READERS have misconstrued ENGINEERING & MINING JOURNAL'S unemotional coverage of the gold situation as an indication of lack of interest in the subject.

We are deeply interested in all significant developments pertaining to gold, and recognize the great stimulus that a higher gold price would give to the mining industry.[1]

But while we watch hopefully for a change in government attitudes and world economic needs that will bring about a higher gold price, we also consider it a disservice to readers to raise false hopes. We certainly cannot ignore the firm stand which the present and previous Government administrations have taken against a higher gold price and the free purchase and sale of gold in the U.S., simply because these facts are unpleasant to us.

Ten years ago, E&MJ published an article "Could the Treasury Raise the Price of Gold Overnight?" (December 1949). Readers were informed that with liberal legal interpretation, the Treasury might be able to do so, but that "there was not the slightest sign that the present administration (Truman) desires an increase in the price of gold or devaluation of the dollar". Unwelcome as this opinion was to many of us, it nevertheless did not mislead anyone.

Later, probing for any signs of change in Government attitude on gold, we asked members of the Senate Banking and Currency Committee "Why can't American citizens buy and sell gold freely, the same as Canadian citizens are privileged to do in Canada?" The gist of the reply from the Senate committeemen was that the $273-billion national debt would not permit the Government to risk disturbing the stability of the dollar by freeing gold at the time. This was reported in an editorial, "Why You Can't Buy, Own and Sell Gold Freely in the U.S.", May 1957.

But it was just as surely stated by the Senators at that interview that the gold in Fort Knox is essential to assure confidence in the dollar.

So we have two basic conclusions: (1) That gold serves a highly useful function in the transaction of international business, and (2) If the price of gold is to be raised, the incumbent Administration must be convinced that it is for the good of the American people and the international business to do so. Crusading among ourselves in the mining industry on the merits of a higher gold price is like hollering down a rain barrel.

While we can't sell the Administration on raising the price of gold now, perhaps changing world economic conditions and a continued exodus of gold from U.S. reserves in the settlement of international balances may force the issue in the future. But in the meantime perhaps Congress can be persuaded to increase our stockpile of gold at Fort Knox by setting up a subsidy for newly-mined domestic gold. Arguments in favor of this move might be listed as follows:

1. It is questionable whether the physical supply of gold at present production rates will continue to be adequate with the almost explosive growth that is now taking place in world commerce and industry.
2. Increased payment to gold producers is the one sure way to stimulate higher gold production.
3. If gold is to maintain its role in international finance, the only way the price can go eventually, is up.
4. A subsidy thus becomes less of a grant and more of an investment for the taxpayer.
5. The idea is not without precedent. Canada instituted a modest gold subsidy for domestic producers.
6. In retrospect, time has proven that the wartime gold mine closing order, L208, was an uncalled for injustice to domestic gold producers. Other nations including the U.K. saw no reason to shut down gold mines to carry on a war. Even Soviet gold mines were allowed to produce during the war with American-made equipment. (E&MJ August 1945 p 108).

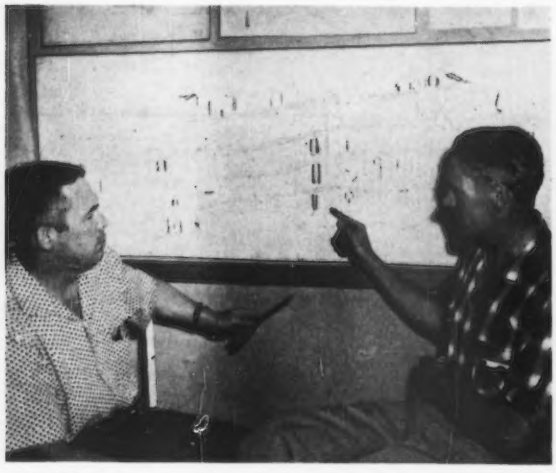
Thus, if we have a national conscience, it might be appropriate to make some amends to our domestic gold mining industry.

Undoubtedly many of our readers will differ in opinions as to whether a gold subsidy, an increase in the gold price, or freeing gold for sale ownership and purchase in the U.S. is the best solution to the gold problem. But whatever measure we choose to promote, let's quit telling ourselves about it, and try to formulate and sell acceptable ideas to the Congress and the Administration where these efforts will do some good. In making this statement we are not ignoring the very able testimony that was presented before Congress by industry leaders, mining association secretaries and Congressmen and others in behalf of gold and the domestic mining industry several years ago. We have studied this testimony at the suggestion of the Senators on the Banking and Currency Committee because they told us that they were cognizant of all the arguments that the domestic industry had proposed in behalf of gold when we asked the question referred to previously. But those in power to make the necessary decisions apparently were unconvinced.

But let's not give up. First we have to build up a valid case for gold which is good for the nation and international trade and commerce, and next sell it to Congress and the Administration.

The timing for action may be propitious in 1960 because financial observers tell us that if U.S. gifts, loans, investments and purchases abroad continue to put a drain on our gold supply, the U.S. dollar may well encounter difficulties during the years ahead.

[1] Recent comments on gold published by *E&MJ* include the February Review by Dr. M. A. Kriz, p 113; "South African Official Attacks Gold Views," September p 132; "American Gold Losses Dominate in 1959," August p 144; and "The Facts Concerning Gold," June p 95.



NORDIC will use rail haulage below the 6th level according to Leslie Browne (left) and Ken B. Doyle, underground super.

COST studies rated rail haulage over trackless. Mine mapping is directed by Ralph Cullen (right) and Frank Mylrea (left).

How Algom Operates a Jackleg Stope

THE STOPING MANUAL discussed below is the result of the combined efforts of all departments concerned with mining at Algom Nordic and was prepared by Ken Livingstone, training and standards engineer. The manual serves many purposes. First, it is a training manual for the new supervisor. Second, it provides a manual for new miners who are trained in special stopes before being assigned to production work. Third, it outlines the best, cheapest and safest mining method. Fourth, it sets down the operating standards—takes care of the ordinary, and leaves time and room for the supervisors to take care of the extraordinary.

LESLIE H. BROWNE

ALGOM NORDIC mine hoists about 4,700 tpd five days a week to provide mill feed for the 3,000 to 3,400-tpd mill (seven days, three shifts). The excess daily tonnage over 3,000 was formerly sold to help feed the Northspan Lacnor mill. At present Nordic is drawing ore from 32 stopes in various stages of production and from 10 to 12 others from which pillars are being recovered. High production rates and efficient ore grade control have been determined as the major means of cutting production cost, and prompted E&MJ's visit in July, 1959.

To maintain ore reserves, the main shaft has been extended from 889 ft with four production levels to 1330 ft, adding four new levels. In August 1959 the underground crusher was moved to its new position below the No. 9 level.

In the beginning of Nordic's mining history, a trackless operation was chosen, based on a relatively large number of surface diamond drill hole ore intersections (105). Planning at some of the other properties in this district depended on far fewer holes owing to much greater depths below surface of the ore reefs. This drilling campaign indicated an orebody averaging 10.5 ft in thickness with a 17° dip and length on strike of about a mile. In the main, the inferences have been found to be sound.

The original trackless stoping system was gradually changed to the methods described later in this article. D-4 Caterpillar tractors fitted with three Gardner-Denver hydraulic booms and D 93 P drifters were used to drill off the face and the broken ore was moved to the loading drift at the bottom of the stope with D-6 Caterpillar bulldozers. Here the ore was loaded into shuttle cars with Joy Mfg. Co. continuous loaders or Eimco 630 machines. The extreme abrasiveness of the ore causing high maintenance costs, the reduction of stope widths from 100 to 65 ft, and the necessity to achieve full production in a hurry, leaving little time to iron out unfamiliar trackless problems, were main factors influencing the change.

However, trackless haulage is still in use. Haulage and loading drifts are driven with three-boom Gardner-Denver jumbos on rubber tires using 12-ft drill steel and Joy 1¾-in bits. Eimco 630 loaders are used to load the broken ore into the shuttle cars. Thirteen shuttle cars—eight Joy Mfg. Co. and five National Mine Service Co. — haul all the ore. To reduce trackless hauls to a 1,500 ft maximum a system of internal ore passes leading to the rail haulage level (No. 5) has been installed. Production ore is hauled in Dorr-Oliver-Long 140-cu ft Granby cars while development ore is hauled in 60-cu ft Granbys. Eimco 21 loaders are used in development headings to load on track levels.

In 1958, cost studies indicated a small margin in favor of track haulage over trackless. Future levels at Nordic will be developed with track haulage. No. 6 is the last trackless level.

Grade control in headings and stopes is exercised by mine supervision aided directly by the geology department. All working places are examined on a daily basis by geologists. The ore limits are marked as a guide to the shift boss and mine captain.

In general, on the west side of the mine the main reef rests on greenstone and on the east side the footwall waste is quartzite.

In the drawings used in the manual,

Mr. Browne is mine engineer, Nordic mine, Algom Uranium Mines Ltd., Elliot Lake, Ont.

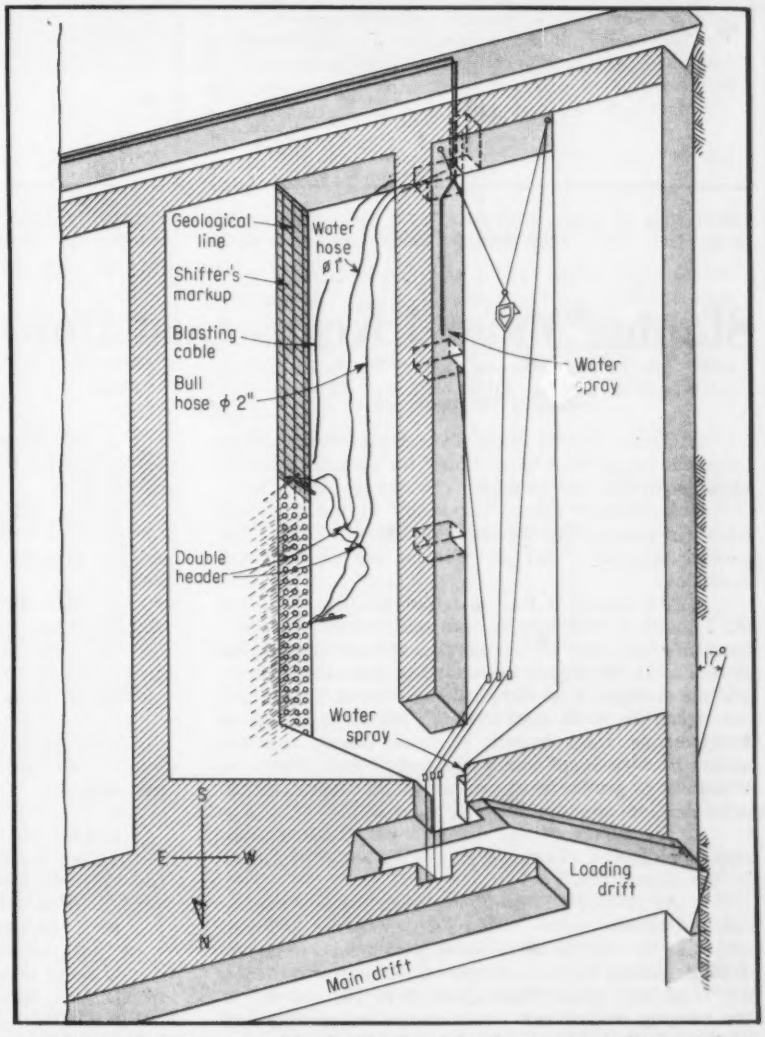
NO. 6 LEVEL will be the last using trackless equipment according to Robert Olsen, acting mine manager at Algom Nordic.

GUIDES underground were geologists—Nordic's Roy T. Poutney (right) and Coldstream Copper's Bob Heim (center).

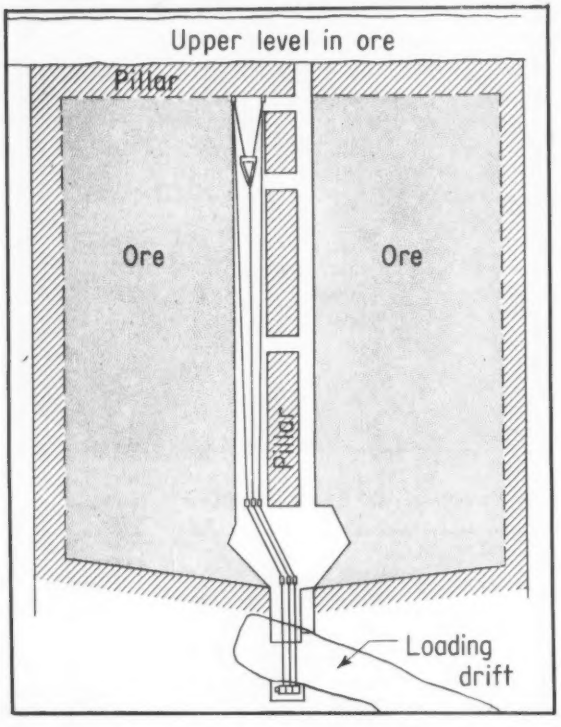
trackless haulage is employed, but mining will be similar on the new track levels, the only basic difference being the stope entry system. Ore will be slushed to box holes at the bottom of which will be chutes featuring air-operated undercut arc gates. In stopes, Joy Mfg. Co. J.A.L. 47 jackleg and Atlas Copco Lion airlegs, Gardner-Denver stopers for roofbolting and Hard Metal drill steel and bits (see p 43, E&MJ September 1959) are used.

On rail levels, the haulage drift will be driven 20 to 30 ft under the orebody and entry will be gained by box-holing up to a sill drift in the ore. The sill drive will stay ahead of the main haulage drift at all times. When the limits of a stope are marked off, a pair of parallel raises are driven updip to the level above. The stope is mined by jackleg longwalling alternating right and left hand panels for drilling and blasting with slushing in the opposite panel to drilling. Studies are proceeding on alternative track methods such as dispensing with the sill drive in ore and developing the stope entirely from a manway raise and box hole from the haulage drift. Another possible system is to drive the haulage drift in ore, slushing over a ramp directly into cars.

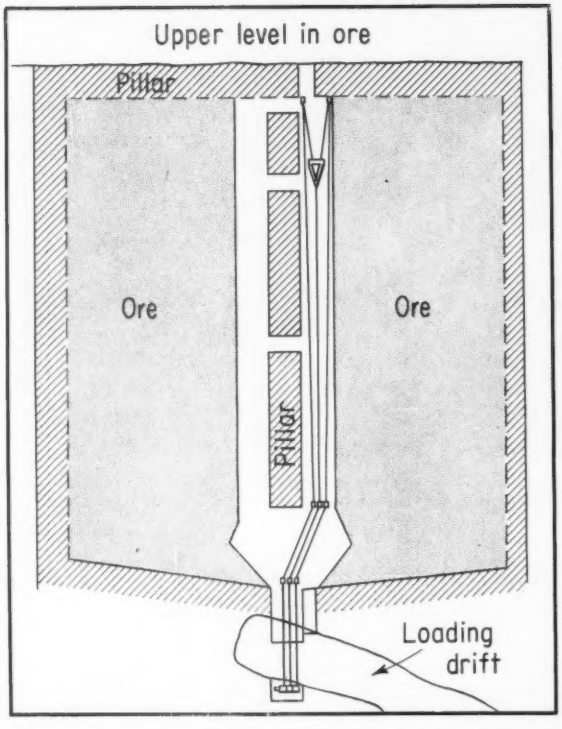
The mine operates two production shifts a day. Maintenance on operating equipment is done on the same shifts. No backfilling is done and little or no timber is used. Rock bolting is practiced where considered necessary and occasional pillars are left in stopes. As set forth in the stoping practice manual, here is how Algom Uranium Mines Ltd. operates a jackleg stope in the Nordic mine.



STOPING MANUAL prepared by the Nordic mining departments and presented on the following gives step-by-step of opening, mining and cleaning out of a stope.



FIRST stage of stoping is to drive 7x7-ft parallel raises updip to the level above, then slash the raises longwall downdip.



WHILE one raise is being drilled off, the slusherman scrapes the other side. Slash holes are angled 30° to the raise face.

Stoping Manual Keeps Cost Down, Grade Up

General instructions

a. Ontario Mining Act and the Algom Nordic safety rules will be in effect at all times. **(In Ontario a miner, upon conviction, can be fined for violating a safety rule).**

b. Supervisors will be responsible for enforcing the rules, for maintaining the standard and the layouts, for meeting schedules, and for efficient use of men and machines.

c. The geologists will be responsible for indicating the location of the hanging wall and footwall contacts, remaining ore and any overbreak. **(Grade control has proven to be the biggest cost-cutter in the Algoma Basin and the geologist is an important member of the production team. In some mines, it is difficult to tell good conglomerate from barren; in some places, uranium occurs in what looks like waste rock. Grade control is important to get the most ore out of the stopes and the most uranium per ton hoisted).**

d. The surveyors will maintain plug lines to indicate development, pillars and measuring points as needed by the supervisors.

e. All drilling will be 12 in. inside the ore boundaries and parallel to the bedding, except where indicated otherwise by conditions. **(Keeping within the ore on the drilling pattern prevents overbreak in any direction—overbreak can cause dilution and drive the cost up; in the hanging wall it can create dangerous spalling and peeling of the backs; it can weaken the pillar line; or it can create slushing difficulties).**

Initial development

a. On completion of the loading drift, the surveyors will establish and maintain the line for the initial development.

b. The 10x6x6-ft slusher slot and the 14x7-ft round for the stope raise is to be marked by the mine captain or shift boss as soon as the layout and line plugs are provided.

c. They will also mark lifters for the stope raise and the offsets according to the layout.

d. Mark the chute hitch 1 ft below the lifters and drill it with 4-ft steel to provide space for cementing and pinning the chute lip.

e. The crew will consist of two experienced drillers. **(Training stopes are maintained in the area mines where miners gain experience before being assigned to production stopes).**

f. Use standard jackleg staging.

g. Drill off the slusher and stope raise rounds full size before blasting. The stope raise is to follow the footwall and, where necessary, is to be driven at a flat angle until the footwall is reached.

h. If the slusher and stope raises are blasted at the same time, use X-107A type caps.

i. Hand muck the stope raise. If the opening is to specification, leave the slusher round untouched.

j. Drill and blast the second raise round, taking the full thickness of the ore.

k. Hand muck this round.

l. Drill and blast the third raise round, then remove enough muck to allow chute construction.

m. Thoroughly clean the slusher slot and remove the muck from the loading drift.

Muck storage area

a. The construction crew will build the chute and install the development slusher—either a 15-hp air or a two-drum 20-hp electric.

b. Add a slusherman to the development crew.

c. The two drillers are to be on the shift opposite the slusherman who will scrape the muck out of the working place, and leave the face clean for the drillers.

d. Drive the raise to the central pillar as a 7x7-ft opening, fanning the walls out and taking the ore down to the hanging wall as the raise progresses. Consult the layout.

e. Notify the surveyors when lines are required for the parallel raises.

Driving the parallel raises updip

a. Each of the two drillers will drill and blast a 7x7-ft raise round per shift, using 8-ft holes as standard.

b. The slusherman will scrape out both rounds on the following shift.

c. The footwall, as indicated by the geologist, will determine the grade.

d. The shift boss will maintain the raise on the line established on the layout.

e. Take breakthroughs to join the two raises as slashes in places designated by the layout as the raises advance.

f. Before the raise advances to within 20 ft of the upper level, hang a blasting mat over the breakthrough area on the level, plank the piping to protect it against flying rock, and check the area for missed holes. **(Raise breakthroughs are to be guarded within 20 ft of the next level according to the rules laid down in the general instruction book).**

g. When the raises are complete, disconnect the air and water lines on the lower level and connect them to those on the upper level. **(Sufficient pipe is removed from the bottom of the raise to give slushing freedom. In practice, this usually means one-third to one-half of the pipe in the raises).**

Development pipefitting

a. Air lines—2 in., split at the entrance to the stope and carried up each raise.

b. Water line—1 in., split at the stope entrance and carried up each raise.

c. Pipe hangers—3-ft rock bolts with chain hangers.

d. Pipe is to be kept within 40 ft of the working face by the development crew.

Gear storage

a. Stow gear as standard practice until the first pillar breakthrough, then store gear in these breakthroughs from then on.

Blasting

a. Caps—Thermalite and safety fuse or electric X-107A caps and blasting cable within 40 ft of the face.

b. Powder—1-in. 70% Driftite.

Controlling the dust

a. Install atomizers and use them within 40 ft of any blast.

b. Turn on the fan and keep the vent pipe within 40 ft of the face.

c. To keep dust counts to a reasonable level, wet the muck thoroughly before scraping starts and keep it wet throughout the shift.

Geologic mapping

a. On completion of the development phase, the longest raise or the one designated by the geologist will be cleaned thoroughly, all muck removed, and the walls and back washed down.

b. Clean the other raise to the extent that geologic features are evident and so that muck will not interfere with drilling.

c. The geologists will map the cleaned face and supervise the sampling of it (chip samples), indicating the ore boundaries with white paint. **(The ore reef consists of conglomerate beds of varying thickness in quartzite. The uranium values occur in the mineralized matrix. As the extremities of the ore zone are approached, the proportion of quartzite to conglomerate increases until it is not economical to mine. In the raise which is mapped and sampled, the hanging wall and footwall are drilled at 20-ft intervals with an airleg-mounted Packsack diamond drill).**

d. A map showing the ore limits is to be supplied to the level captain.

Stoping the ore

a. The construction crew is to replace the development slusher with a three-drum 50-hp electric slusher on a permanent mounting. **(Algom Nordic uses 20-hp two-drum Joy electrics and 15-hp two-drum Canadian Ingersoll-Rand air slushers on development and either 20-hp or 50-hp Joy three-drum electrics in production stopes).**

b. Stoping crew will consist of two drillers and slusherman.

c. The shift boss or captain is responsible for maintaining grade as indicated by the geologists and is to use yellow paint to mark drilling boundaries.

Enlarging the raises

a. The standard method of opening out the 7x7-ft development raises will be downdip longwall slashing.

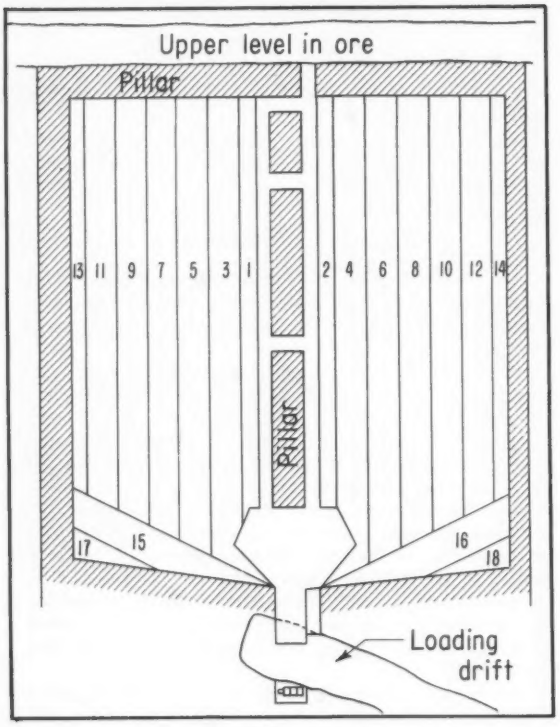
b. The shift boss determines and paints the vertical line for the slash rows with the drilling line at an angle of approximately 30° to the raises. Hole burden is to be 3 ft.

c. If the acute angle formed between the face and the drill steel is 30°, 35°, 40°, or 45°, then the distance between collars along the face should be 6 ft, 5.2 ft, 4.7 ft or 4.2 ft respectively.

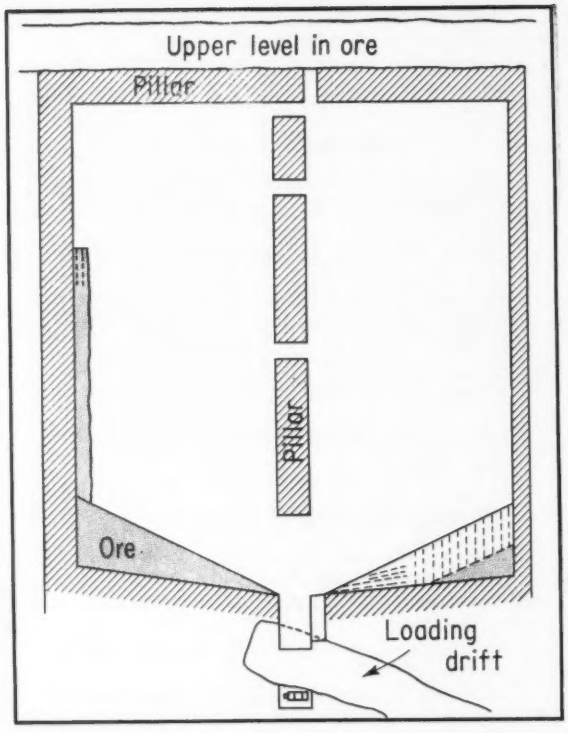
d. Steel used will be approximately 8 ft. If the acute angle between the drill hole and the face is 30°, 35°, 40° or 45°, then the longwall advance between holes should be 4 ft, 4.6 ft, 5.2 ft or 5.7 ft respectively.

e. Complete the mark-up of the raise as soon as possible. The number of backsights needed will depend on the skill of the miner, but every fourth row should be painted.

f. Use three holes per row. Start drilling at the bottom of the raise and move updip.



LONGWALLING proceeds as shown above until the stope has been mined out. Occasional, irregular pillars may be needed.



FINAL clean-up involves taking any ore left in the footwall, hanging wall and trimming pillar lines by downdip slashing.

g. Two experienced drillers on a shift form a crew, the men being separated by 15 ft when drilling the initial slash.

h. At least the first six rows of one slash will be drilled and blasted before the 50-hp slusher is installed. Further blasting may be done with care so as not to block the raise. Place a blasting mat in front of the slusher if there is a chance of it being damaged.

i. Drillers will drill pin holes for slusher eye bolts after each blast.

j. The drilling crew moves into the other raise and the work there follows the same pattern as above.

k. Any drilled slash remaining in the first raise will be blasted by the drillers as ore is needed to maintain slushing schedule.

l. As the slash is being drilled and blasted in the second raise, the first longwall is being slushed and prepared for the drillers.

m. Cycle should be arranged so that the scraping and drilling sequences will be complete at the same time and that no delays in changing sides will be encountered. **(The lower one-third of a stope is blasted from the lower level and the upper two-thirds from the upper level. Ore production rate is usually about 3,000 tpm from any one stope. Five levels are in production at the present time with development work about to begin on opening two more. Of the five levels, one has three stopes remaining, another is about 50% developed and the other three are about 90% developed).**

Blasting

a. Powder—1-in. 75% Dygel.

b. Caps—S.P. electric with blasting cable from the level above within 20 ft of the last hole to be blasted.

Pipefitting

a. On completion of the development raises, pipes were connected to those on the upper level.

b. Use pipe already in the raise while slashing the raise.

c. As blasting advances updip, remove the pipe at least 20 ft ahead of the blasting area.

d. When the pipe has been removed to the upper level pillar, install double headers on each line to provide air and water for each side of the stope.

Starting new longwalls

a. In locations where blasted muck will not damage the slusher, a downdip fan of holes can be used to enlarge the storage area and provide a new longwall face.

b. Use an updip fan if the slusher is in danger.

c. Trimming of the bottom portion of the stope may be required to maintain a smooth regular face. Keep the face at an angle of 25 to 30° to make scraping easier.

Longwalling downdip

a. Regular practice will be downdip, longwall stoping.

b. Burden between holes is to be 3 ft. Drill holes to a depth of 12 ft with three holes per row, looking downdip at 55° to the longwall breast.

c. Horizontal distance between collars will be 3.7 ft to give a three ft burden between rows—advance across dip on each longwall blast will be about 11 ft with this pattern.

d. The shift boss will paint the rows on the face,

backsighting as needed according to the experience of the miners, but with at least one every seven rows.

e. Mark the footwall drilling line.

f. The hanging wall drilling line will depend on the thickness of the ore.

g. Start longwall drilling at the base of the stope and work updip in a continuous drilling and blasting cycle until the upper pillar is reached.

h. A breast of approximately 7 ft in height is taken under ideal conditions. Where ore thickness exceeds 8 ft, leave the ore above the 7 ft height in place as a general rule. It will be slashed later on clean-up. **(If the back appears sound and rock bolting isn't necessary, this practice is followed. However, with heavy ground conditions, the ore is taken down to the full thickness soon after the longwall, and the back is roof-bolted).**

i. Blast holes drilled on each shift. Do not allow broken muck to fill the opening to the extent that it interferes with slushing.

j. As the longwall advances and after each blast drill new pin holes in the upper part of the next longwall and in the backs for installing the eye bolts.

Cycle sequence in the stope

a. Continue drilling until the longwall is complete.

b. Move drill gear and equipment to the other stope panel.

c. Move slusherman into freshly blasted panel.

d. Continue drilling and slushing in the regular manner.

e. Any holes left unblasted in the other stope panel will be blasted at the proper time by the crew.

f. Always drill and slush in separate panels.

Blasting

a. Powder—1-in. 75% Dygel.

b. Caps—S.P. electric, from the level above using blasting cable within 20 ft of the last hole to be blasted.

c. Whenever possible, blast on each shift.

Pipefitting

a. At the start of longwalling, install a regular 2-in. bullhose airline and extend it to within 40 ft of the drilling face. Fit a double header to the end of the bullhose to provide an outlet for each machine. Set up a 1-in. water line by the same method.

b. As the longwall retreats updip, remove the surplus hose and store it on hangers placed in the top of the stope.

c. Repeat the cycle on moving to the opposite panel.

Controlling the dust

a. Place an atomizer as close to any blasting point as possible and spray the water directly on the muck. **(The high silica content of the ore—quartz pebble conglomerate in quartzite—makes it necessary that the muck be thoroughly wetted down to keep down the dust count).**

Slushing practice in general

a. The stope should by now have been provided with a three-drum-50-hp electric slusher with standard blocks, cables, auxiliaries and a 60-in. scraper.

b. Install on permanent type eye bolts in front of the slusher three blocks—one to each drum—so that orderly winding and unwinding of the cable takes place.

c. As a safety device in the event of an anchorage failure, install two ¾-in. cables from the slusher to eye bolts in the walls behind the slusher.

d. Install a rope guard on the front of the slusher, securing it to the back and to the slusher.

Slusher operation

a. Slusherman—one to a shift.

b. Operation shall be in accordance with instructions in "Slusher Training" in the training manual.

c. During the slushing of the raise slashes, take care that the blocks are properly positioned to prevent excess wear on the cable through rubbing on the muck.

d. During slushing of the longwall breasts, position the tail blocks at the upper level pillar to avoid unnecessary moves and provide maximum time on production.

e. Clean down the area along the next longwall breast after the main slushing has been completed and expose the lifters. Flush and examine all bootlegs. The face should be thoroughly washed down.

Sandblasting and mudcapping

a. Use X-107A electric caps, 75% Dygel and No. 10 Twist blasting machine.

Dust control while slushing

a. Dampen all muck thoroughly before slushing.

b. Any muck loaded on haulage equipment must be thoroughly wet. Use at least two water sprays in the stope—one constantly wetting the muck before it is moved and the other wetting the muck in the storage area. **(In practice, the muck is wet down by the slusherman with a water hose at intervals during the shift. Research is being done at the present to find or design a suitable spray).**

Backslashing practice

a. The geologists will determine the thickness of the ore remaining in the back.

b. Slash the ore when conditions warrant as decided by the captain. Where the hanging wall remains firm, extend the stope to the outer pillar and take down the backs as a last step in the stoping operation.

c. When the ore tends to loosen, take it down over the mined width and roofbolt the waste where necessary as provided below.

Backslashing—Method No. 1

a. Hanging wall conditions permitting, backslash updip starting about 20 ft from the upper level pillar.

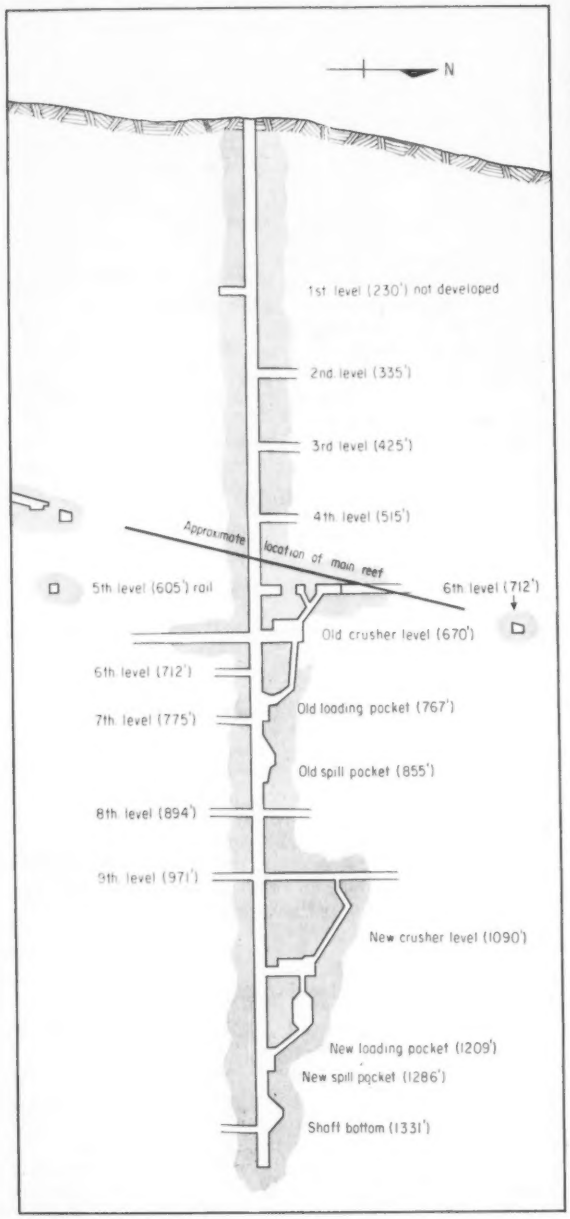
b. Space holes at 4-ft intervals, 12 in. below hanging wall contact.

c. If the ore thickness exceeds 4 ft, use a second row of holes, space above and between the lower rows to reduce the size of the muck.

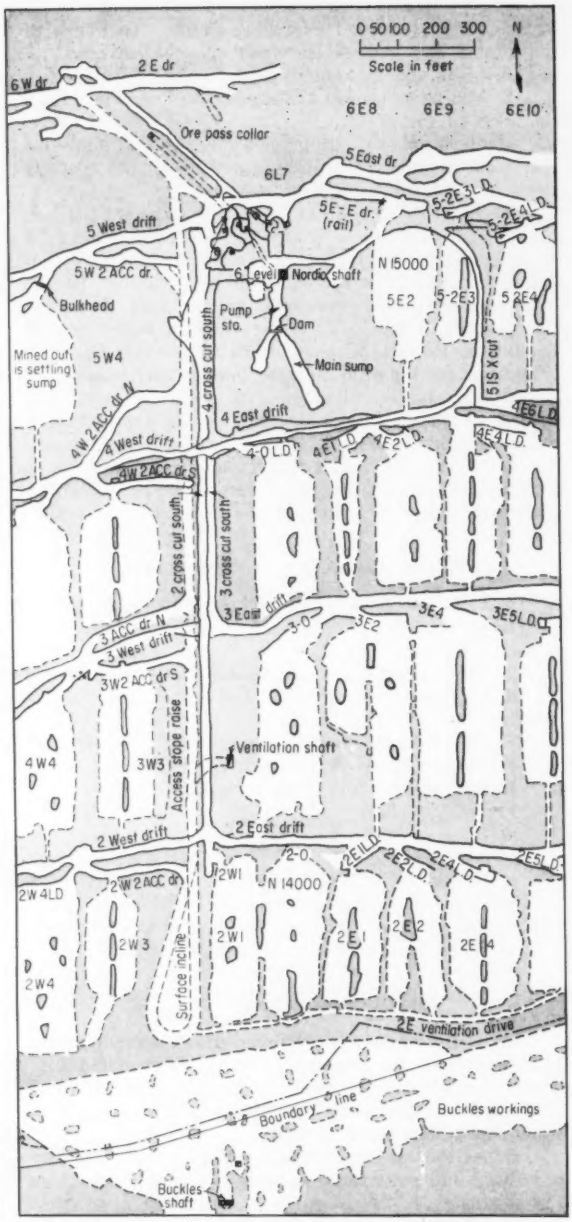
d. Depth of holes will be 12 ft—take care to avoid breaking into the hanging wall waste.

e. Carry out the first slash updip to the upper level pillar. After the first row has been blasted, use the muck as a platform.

f. After completing the updip slash, take the remaining ore downdip.



FIVE levels—2, 3, 4, 5 and 6—are in production: one has 3 stopes left, the 6th is 50% and three are 90% developed.



PLAN of the mine near the shaft shows the orebody dipping from the outcrop near the Buckles shaft in the lower center.

g. During this stope cycle, slush only when the muck pile interferes with drilling and blasting.

h. Drilling crew is responsible for drilling pin holes in the back at regular intervals and for sandblasting the oversize muck.

Backslashing—Method No. 2

a. When hanging wall conditions do not permit slashing to start in the stope, take the back down by a fan of holes starting from the raise at the upper level pillar.

b. Carry the breast across the stoping width, along the upper pillar.

c. On completion of this initial slash, carry out normal downdip slashing.

Blasting

a. Powder—1-in. 75% Dygel.

b. Caps—S.P. electric, with blasting cable to within 20 ft of the breast.

c. Prime center holes with a zero cap.

d. Use No. 1 caps on holes on either side of center.

e. Continue to load on this pattern.

UNDERGROUND haulage is handled by three 7-ton Ruston diesel and three 7-ton Mancha Titan battery locomotives.

GRADE control is a prime operating factor at Nordic. Another visitor was geologist Don Zimmerman (left), Australian AEC.

Rock bolting practice

a. The regular rock-bolting crew does the stope bolting as needed.

b. Standard practice is to bolt when necessary. **(This is left to the discretion of the mine captain concerned. He marks the area and the bolts are put in on 4-ft centers. Closer spacing is used if conditions warrant).**

c. Follow the rock-bolting practice laid down in the general instruction book. **(Algom Nordic uses ⅝-in. dia bolts in 6- and 8-ft lengths with 1¼-in. shell. Plate is 5x5 in., ⅜ in. thick. About 4,700 to 4,800 bolts are installed each month. Bolt recovery is not practiced).**

Trimming the outer pillars

a. The surveyors will place plug lines by means of which the outer pillars will be established.

b. The supervisor must keep close check on the pillar thickness while trimming is in progress. Take offsets and place them on the map each shift.

c. Drill 12-ft test holes through the pillar every 15 ft as checks on thickness—pillar walls should be the same thickness as on the map.

d. Carry out normal longwall stoping as close to the pillar as possible.

e. Trim to the final established pillar line downdip.

The pillars at the base of the stope

a. The surveyors will place plug lines to establish the lower pillar walls.

b. Take the first slash across dip so that the muck is thrown updip and away from the slusher. Start initial slashing at the storage area and work towards the outer pillars.

c. Once a face has been established and there is no danger to the slusher, drill and blast downdip so the muck is thrown toward the center of the stope.

d. Continue the cycle until the pillar line is established.

Leaving pillars for ground support

a. Pillars may be left in stopes at irregular intervals where, in the opinion of the captain, the condition of the back warrants.

b. Removal of any of these pillars can only be done with the permission of the underground superintendent.

Clean-up

a. Do the initial stope clean-up with a 50-hp slusher.

b. The geologists will examine the stope for ore left in place in the footwall or hanging wall—if there is enough to bother with, drill and blast it out.

c. After initial clean-up is finished, install a three-drum 50-hp remote control slusher and thoroughly clean out the stope.

d. Wash down the footwall—remember "broken ore has already been paid for."

Mining narrow stopes

a. The ore becomes thinner toward the outer fringes of the orebody and other stoping standards must be employed.

b. Minimum height in a stope is 5 ft.

c. Where the footwall ore is on a quartzite contact, mark the drilling line as usual—12 in. below the hangingwall. Mark the footwall drilling line 4 ft below this. Any dilution necessary to maintain the 5-ft height must be taken in the footwall. **(Occasionally uranium values occur in the footwall.)**

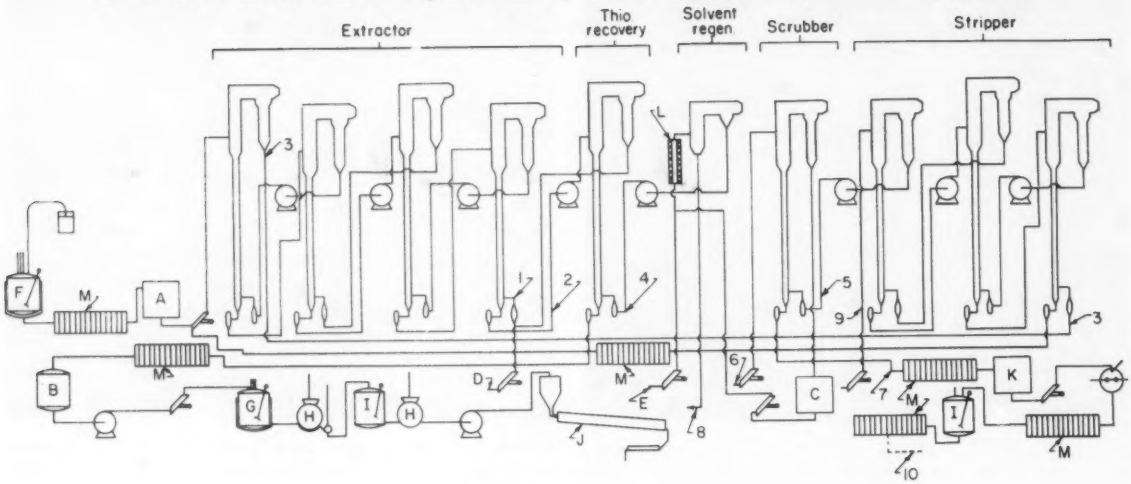
d. Where the footwall ore is on a greenschist contact, mark the drilling line at 18 in. above the footwall. Any dilution necessary to maintain the stope height must come from the hanging wall. **(The greenschist is a high consumer of acid in the mill.)**

Variations from the standards

a. These standard practices will be in effect in all stopes, except where permission to deviate is obtained from the underground superintendent.

b. When standards relating to methods or materials are changed, written notice to that effect will be given to the supervisors by the underground superintendent.

Solvent Extraction Flowsheet For Zirconium-Hafnium Separation U. S. Bureau of Mines (operated by Wah Chang Corp.), Albany, Ore.



LEGENDS

1. Solvent feed
2. Hafnium-free zirconium raffinate
3. Hafnium-laden solvent extract
4. Regenerated solvent
5. Solvent stripped of zirconium
6. Scrubbing acid 5N H_2SO_4
7. Zirconium-free hafnium raffinate
8. Recovered NH_4CNS to feed makeup
9. Stripping acid, 3.6 to 3.9N HCl
10. Hafnium hydroxide
- A. Feed solution storage tank
- B. CNS-free zirconium raffinate storage tank
- C. Scrubbed solvent tank
- D. Scrubbed solvent pump
- E. Pump, 28% NH_4OH
- F. Feed makeup vessel
- G. Sulphate precipitation vessel
- H. Rotary filters
- I. Hydroxide precipitation kettle
- J. Kiln
- K. Hafnium raffinate storage tank
- L. Solvent regenerator
- M. Filters

From U.S.B.M. R.I. 5499

Separating Hafnium From Zirconium

THE LOW NEUTRON cross-section of zirconium and the very high neutron cross-section of hafnium makes the two sister metals very valuable in certain nuclear power reactor applications. Unfortunately, the high and low barn numbers of hafnium and zirconium, respectively, require that the two metals be separated to considerable degrees. To make the separation, Carbide Carbon Chemicals Corp. developed a solvent extraction process that starts with zirconium tetrachloride and yields a low-zirconium HfO_2 and a low-hafnium ZrO_2. Then the oxides are melted and refined to metal in the Kroll Process.

USBM built a solvent extraction plant at Albany, Ore. which has led to the successful erection and operation of several other privately owned separating plants. Wah Chang Corp. operated the Bureau's plant at Albany Ore., and built and operated its own there also. Both of these are now closed. Carborundum Metals Corp. used the same basic process at their Akron, N.Y. plant (closed) at their newest plant at Parkersburg, W. Va. Mallory Sharon and Columbia-Southern operate similar zirconium-hafnium separation plants as described below from U.S. Bureau of Mines REPORT OF INVESTIGATION 5499, "Zirconium-Hafnium Separation", by William A. Stickney.

The Albany, Ore. zirconium-hafnium separation plant was built and operated for the Atomic Energy Commission, patterned after a plant operated by Carbide Carbon Chemicals Corp. at Oak Ridge, Tenn. Construction was begun in April 1951. Hafnium was to be extracted preferentially as hafnium thiocyanate from an aqueous mixture of zirconyl and hafnyl chlorides in hexone (methyl isobutyl ketone) by a liquid-liquid counter-current system.

Albany was designed by the Bechtel Corp.; Bureau of Mines personnel devised the process flowsheet, erected the building, and installed the equipment. The building was completed in January 1952. The Bureau purification plant began operating in April 1952 to produce low-hafnium zirconium oxide and low-zirconium hafnium oxide. The original design capacity was 6,283 lb per week of contained metal in $ZrCl_4$ or oxides having a hafnium-zirconium ratio (Hf/Zr + 1/Hf + 100) of 2:1. Basis for this designed capacity was 44 lb of contained metal in feed per hour, with an operating factor of 85%. Actual operating efficiencies were about 90%. In 33 months of operation about 806,000 lb of reactor-grade zirconium oxide and 21,000 lb of hafnium oxide were produced in the plant. Metal recoveries were gradually increased from lows of 85% for Zr and 70% for Hf to essentially 98% for Zr and 100% for Hf. Operator experience and modifications of procedure were the main factors in improvement. Over-all efficiencies for the operation were 88.8% for Zr and 91.3% for Hf.

After 33 months of continous activity, during which time 2,500,000 lb of $ZrCl_4$ was processed, the Albany purification plant ceased operations. Shortly thereafter, to stimulate private industry to meet the zirconium requirements of the stepped-up reactor development program and the projected demands of the Navy, AEC requested bids for the production of 2,200,000 lb of zirconium in a five-year period. The successful bidders were U.S. Industrial Chemicals Co., National Research Corp., and Carborundum Metals Corp. In addition, the Bureau of Mines production facility was reactivated by Wah Chang Corp. for a two-year period. During that time approximately 600,000 lb of

pure zirconium sponge was produced.

The feed to the separation plant consisted of an aqueous acid-chloride solution containing zirconium and hafnium, present as thiocyanate complexes. The aqueous feed was passed through 4-in. glass columns countercurrent to a mixture of methyl isobutyl ketone and thiocyanic acid, which selectively extracted hafnium plus about 30% of the zirconium. The aqueous zirconyl chloride solution (raffinate) leaving the system was essentially Hf-free and was sent to a recovery system. The organic stream from the extractor went to a stripping column where the Zr was extracted from the organic phase by a HCl solution.

The aqueous solution was recycled back through the feed line to the extractor. The organic phase from the stripper entered a scrubber column where the Hf was removed by an H_2SO_4 solution. The scrubbed organic stream flowed to a storage tank, and from there about 40 gal per hr were sent to regeneration and the remainder returned to the extractor system.

The solvent was regenerated in a heat exchanger using 28% NH_4OH to remove thiocyanate and provide solvent feed for the thiocyanate recovery column. The NH_4CNS solution formed in regeneration was used in feed makeup. Thiocyanate was recovered by passing the regenerated solvent through the zirconium raffinate from the extractor. The thiocyanate-enriched solvent was returned to the extractor.

The sulphate precipitation was accomplished in a 200-gal glass-lined, jacketed reactor. The zirconyl chloride solution containing 0.7 lb of Zr per gal and 1 N free HCl entered the vessel where it was mixed with enough H_2SO_4 to obtain a zirconium-to-sulphate ion ratio of 2.5: 1. This ratio was maintained with proportioning pumps, and the allowable range was large enough to tolerate the slight variations in zirconium concentration in the plant raffinate.

While slowly mixed, the solution was heated to 90° C. or higher, diluted with water to 0.1 lb of Zr per gal, and adjusted to a pH of about 1.4 with NH_4OH. The narrow pH range of 1.3 to 1.5 was maintained by automatic controllers. Precipitation was rapid, and more than 99.98% of the Zr was precipitated at these conditions. Lower temperature or deviation in the zirconium-to-sulphate ratio of 2.5:1 resulted in lower zirconium recoveries.

Handling the Hydroxide Slurry

The reaction products were removed from the bottom of the vessel through a gravity leg to a 3x4-ft rubber-covered Eimco rotary vacuum filter. The discharged basic $Zr(SO_4)_2$ filter cake was sent to a repulper where filtrate from the final filter, approximately 28% NH_4OH was added to promote conversion to $Zr(OH)_4$ at pH 10. The $Zr(OH)_4$ slurry from the first repulper was pumped to the chlorination plant where it was filtered on a 3x6-ft wood-deck Oliver rotary vacuum filter. The rejected $(NH_4)_2SO_4$ solution was passed through a polishing press to the sewer, and the cake went to a second repulper. NH_4OH (28%) was again added to maintain pH 10. The repulped slurry was then pumped to a 3x6-ft Eimco filter which discharged the zirconium hydroxide filter cake to a rotary dryer, and the filter solution was sent back to the first repulper.

To lessen the tendency of the filter cake to stick to the walls of the rotary dryer, the material was semi-dried by infrared lamps mounted over the endless belt conveyor.

The dryer is an indirect, electrically fired rotary shell made of type 316 stainless steel. It is 3 ft in dia and 30 ft in length, rotating at 6 rpm. Three heating zones were maintained at temperatures of 350°, 375°, and 400°C. for controlled drying of the $Zr(OH)_4$. The dried product was discharged by gravity to an 18-in. dia., 12-ft-long, rotary, electrically heated Thermalloy retort operated at 700° C. for calcining. Calcined product was accumulated in 50-gal open-top steel drums in which it was weighed and sampled.

Precipitating the Hafnium

The aqueous $Hf(SO_4)_2$ solution from the scrubber column was collected in two 1,200-gal corrosion-resistant steel tanks. Solution was collected in each tank for a 24-hour period, after which the flow was diverted to an alternate tank. The stored sulphate solution was then neutralized and the Hf precipitated by moving the solution to a water-jacketed cooler unit where it was contacted with a 28% NH_4OH stream. A small tank was installed above the ammonia pump to provide a constant head.

The proportioning pump used on the ammonia supply line replaced an earlier flowmeter which tended to vary as a result of fluctuating back pressures from the filter press. Milton Roy microadjustment proportioning pumps were used to provide a hafnium solution flow of about twice the plant discharge rate (55 gal per hour) and NH_4OH to maintain a pH of 9.0 to 10.0. Both pumps were interconnected with a pressure switch which shut off the power when the filter press became full.

Precipitation of the hafnium was controlled by the pH. For an average raffinate flow of 110 gal per hour, about 24.5 gal per hour of 28% NH_4OH was required. The precipitated solids were filtered out by a plate-and-frame filter press. The filtrate went to the sewer, and the cake was thoroughly washed by passing water through the press. After washing, air was forced through the filter to partially dewater the cake, which then was stored in stainless steel pans.

As the need for hafnium increased, greater emphasis was placed on recovering it. From an early average recovery of 71%, later process modifications resulted in essentially 100% of the hafnium being recovered in the form of precipitated hydroxide. The hafnium output per month was increased from 650 to 780 lb.

This increase was accomplished essentially through the modernization of handling equipment and operating techniques. The more important changes providing improved efficiency consisted of installing mechanical seals and all transfer pumps, eliminating two former repulping steps in the precipitation of hafnium to minimize handling losses, recovering and burning all filter papers, which saved 5 to 10 lb of hafnium per month, and replacing the flowmeter on the ammonia line with a positive displacement proportioning pump.

During the last few months of plant operation, off-specification hafnium product was received from Carborundum Metals Corp. for processing. This chloride product was added to the plant feed, which increased the hafnium content of the feed from about 2.0 to 5.0%. As a result, plant hafnium production per month was increased to over 1,000 lb of hydroxide.

During 33 months of operation the purification plant at Albany, Ore., processed 2,500,000 lb of commercial zirconium tetrachloride to produce low-hafnium zirconium oxide and low-zirconium hafnium oxide. The average hafnium content of the zirconium oxide was about 40 ppm and the hafnium oxide contained less than 2% Zr. The separate oxides were converted to sponge metal by the Kroll Process in another section of the plant.

Although corrosion was a major problem, modifications of equipment by adoption of resistant materials, and continuous washing down and maintenance of equipment and plant served to reduce materially the corrosive action of the chemicals.

The purification plant was closed in December 1954, and the rest of the plant ceased operation on July 1, 1955.

From U.S.B.M. R.I. 5495

Table I—Comparative Service Life of Mine Equipment Exposed to Acid Mine Waters

Item	Location*	Typical Description	Previous Material	Life, Months	Present Materials	Life, Months	Remarks
Cable, shaft bell	all	800 ft. long	galvanized mild steel	6	302 ss	71	
Cable, cage counterweight	all	5/16 & 3/8 in. dia.	mild steel	3	302 ss	36+	
Side plates, cage	c	n.a.	mild steel	24	302 ss	84+	
Pipe, mine water	all	10¾ in. OD	rubber lined steel	36–60	304 ss	++	ss less costly
Pipe, changehouse	f	½–2 in. OD	hard copper	60	304 ss	36	no corrosion to date
Pumps, mine water	c, l	Mather and Platt				Satisfactory	pH 3.5
		impeller			347 ss		
		shaft			347 ss		
		sleeve			347 ss		
		wear rings			431 ss		
Pipe, mine water discharge	c, l	1½ in. OD	n.a.	n.a.	304 ss	Satisfactory	pH 3.5
Valves, mine pump	all	6 in. dia. gate & check	cast carbon Mo alloy	6–9	304 ss	Satisfactory	comparable price
Bolts, shaft guide bracket	all	¾ in. OD x 10 in. long	n.a.	n.a.	304 ss	Satisfactory	
Ladder rungs	f	⅞ in. OD rod	mild steel	36			
		¾ in. OD pipe	mild steel	5–19	403 ss	240	
		¾ in. OD rod					
Coils, water heating	f, g	U-bend	copper	12	304 ss	72+	
Fan, intake & exhaust		blades 72–120 in. dia.	n.a.	n.a.	304 ss	Satisfactory	Source: International Nickel Co.

*c = Creighton mine
f = Frood Mine
g = Garson Mine
l = Levack Mine
s = Stobie Mine
} Sudbury area, Canada

How to Select Stainless Steel For Use in the Mining Industry

Part II. Experience With Stainless in the Field

RICHARD E. PARET

FIELD SERVICE experience with the stainless alloys in mining and ore refining equipment is the basis for present increasing use of these materials. But case history evidence is not infallible. Unless all facts are known, comparisons can be misleading. With all materials, including stainless, response to two similar or even related services may differ vastly.

Therefore, laboratory test data should be considered no more than indicative. Actual service experience with stainless must be the standard for final judgment and acceptance.

Stainless has shown itself over the years a highly versatile material suitable for many uses. Generalizations based on experience thus are feasible.

Mr. Paret represents the Committee of Stainless Steel Producers, American Iron & Steel Institute, New York, N. Y. Part I appeared in the December 1959 issue of E&MJ.

Mining

Corrosive conditions encountered in open pit and underground mining are well known. Corrosive mine waters often are supplemented by harsh fumes and abrasive material. All can lead rapidly to failure of materials less resistant than stainless. In many instances, service tests of equipment have led to adoption of stainless as a standard. Table I lists examples of significant applications.

At one unusual installation in service since mid-1956, a 16½-ft dia austenitic stainless fan operates continuously in all weather to air condition a large nickel mine. The 12-blade fan moves more than 750,000 cfm of fresh air containing dust and traces of sulphur dioxide. Intake air temperature ranges from 25° below zero in winter to more than 100° F in summer. Blades continue smooth and corrosion-free to date.

Prevention of stream pollution is the task of another stainless unit. Acid mine water is neutralized inside the equipment with measured amounts of lime, then flushed to a natural stream. The constant diet of lime and acid would quickly erode most materials. Stainless, reports the mine operator, resists corrosion and makes the operation practicable.

Sizing and Classification

Stainless first was introduced to the screening stage of processing by coal mining operators, who employed it successfully in materials handling and sizing equipment. Acid corrosion caused by wet coal severely restricts the useful life of non-stainless dewatering, desanding, and sizing screens.

Screens of austenitic or ferritic stainless steel generally outlast other materials by a four-to-one margin. Blinding generally is eliminated by the alloys' smooth surface, which lets

Table II—Comparative Service in Coal Processing Equipment

Description	Type	Stainless Steel Life, Months	Carbon Steel Life, Months
Final refuse conveyor	410	66	6
River tipple chute	410	70	6
Classifier	310	96	12
Transfer chute (river tipple)	301	54	6
Shaker screens (washer)	410	48	5
Washed coal cross conveyor	410	84	8
Door thickener underflow feed pipe	316	180	12
Hydraulic classifier	302	66	n.a.
Jig feed chutes	410	60	6
Dryer chutes	302	36	6
Raw coal screen	410	6	−1
Raw coal screen, dewatering	410	6	−1
Primary screen-top	410	6	−1
Primary screen-bottom	410	3	n.a.
Launder screen	302	2	impractical
Secondary dewatering screen	410	7	−1
Bottom-deck refuse screen	410	3	impractical
Sand sump top screen	410	indefinite Req. occ. rep.	impractical
Raw coal chute	410	18	2
Outside loading chute	410	18	2
Cent. drier baffle plates	410	8	impractical
Refuse chute	410	24	6
Cone feed chute	410	24	8
Clean coal loading chute	410	54	18
Raw coal conveyor	410	54	18
Desilting screen	410	6	−½
Primary dewatering screen plates	410	7	n.a.
Elevator discharge chute—wet raw coal	302	30	12
Elevator discharge chutes—dry clean coal	302	84	12
Track loading chute	302	48	12
Raw coal shaker chute	302	90	10
Raw coal feeder at bins	302	36	12
Miscellaneous conveyor track bars and wear strips	410	48	12

coal pass easily. In one installation, producing about 2,500 tons of anthracite weekly, stainless screens for dewatering troughs need now be replaced only about every 18 months. Carbon steel screens blinded and failed after eight months or less in the same service.

Recovery of ore fines through stainless steel filter cloth now is standard practice in many mines. Previously used cotton filter cloth required frequent replacement, and could not be woven fine enough to make recovery worthwhile. Table II lists other typical milling applications.

Classifiers of stainless steel are often preferred where slurry is corrosive as well as abrasive. Constant exposure to acid waters under these conditions makes carbon steel equipment impractical.

Materials Handling. Stainless conveyors and elevators for transport of ores and concentrates find increasing use. Screw-type conveyors are subject to heavy abrasive forces. Where corrosion (however mild) also enters as a factor, stainless steel screws are considered the best choice, according to many operators.

In handling of ores, concentrates, and solid fuels, stainless steel hoppers and chutes not only provide long life but do so at low cost. Under conditions of continuous exposure to moderate abrasion forces and corrosive action, clad stainless steel frequently proves an economic investment for hopper and chute equipment.

In one ore handling evaluation carried out by a Pennsylvania coal company, test plates of stainless clad types 304, 410 and 430 were installed as bottom wear plates in a drag conveyor. More than 26 months later, after 920,341 tons of coal had moved over the wear plates, samples were removed for inspection. The austenitic clad plate lost .001 in. from the stainless surface. Types 410 and 430 each lost .004 in. from the stainless surface, with slight pitting observed. During this test period, two sets of 0.25 in. thick steel armor plates wore out completely.

Test plates were constructed of 0.25 in. thick carbon steel clad with 20% stainless in each grade. Reference samples were retained, and cladding thicknesses were measured with a magnetic thickness gage before and after service.

The test makes possible recommendation of type 304 stainless clad for coal chutes. While the 400 series clad steels are adequate where the chute is swept clean, pitting may occur in locations where the coal may accumulate.

Smelting

Use of stainless equipment in smelting is well-established, as shown in Table III. The typical sequence of events at a smelter, in introduction of stainless, first involves use of the material as crane hooks and removable hopper liners in lift trucks. Next, the alloy frequently is installed in difficult-to-maintain locations, such as chimneys, where labor time in replacement is the biggest cost. At this point, designers may consider stainless for continuous-heat use—first in indirect furnaces, and later in direct-fired furnaces. Burners of stainless steel alloys are well accepted in reverberatory furnaces.

Stainless steel has been successfully used in chutes handling sulphide concentrates. At one smelter location, it is said to outperform galvanized steel by 15 times.

Refining

Nearly 80% of the nation's electrolytic refining capacity is concentrated in copper. Zinc accounts for an additional 18%. Other metals provide the balance.

In electrolytic refining, sulphuric acid is the principal agent. Usually it is used in the concentration range of 15 to 18%, at temperatures of 43 to 55° C.

Earlier design practice for such refining equipment regarded corrosion as inevitable and the choice was between carbon steel and cast iron. Past designs in these metals provided generous corrosion allowances, perhaps with walls up to several inches thick. Where better corrosion resistance was required, lead was specified. However, lead's properties make it too expensive in certain applications.

Within the past decade, declining profits and increasing wages in the refining industry accelerated an existing trend toward modernization. The single most vulnerable cost problem was corrosion. With little hesitation, designers turned to the family of stainless alloys to cope with their corrosion problems.

In most instances these problems are heightened by the tendency of any corrosive environment to become even more destructive as temperature increases. And most refining operations are carried out at higher than ambient temperatures. Maintenance-free performance has been recorded for stainless used in hot solution storage

Table III—Comparative Service of Stainless in Smelter Equipment

Item	Description	Previous Material	Life, Months	Present Material	Life, Months	Service
Pipe	711 lineal ft, 16 in. OD, 16 gage	n.a.	n.a.	318 ss	satisfactory	75% SO_2 gas
Chimney cap	atop 300-615 ft. concrete stacks	n.a.	n.a.	special ss 308	satisfactory	SO_2 bearing smoke
Lightning rods	stack top	n.a.	n.a.	316 ss	satisfactory	SO_2 bearing smoke
Bolts, chimney	1-in. dia. x 15-in. long	n.a.	n.a.	317 ss	satisfactory	SO_2 bearing smoke
Bands, chimney	⅜-in. thick x 3-in. wide	n.a.	n.a.	317 ss	satisfactory	SO_2 bearing smoke
Chute lining	roaster feed bins	18 gage galvanized sheet steel	7 days	302 ss	90 days	11.5% moisture, heavy abrasion from nickel concentrates
Bolts, converter hood	⅞-in. dia. x 5-in. long	n.a.	n.a.	416 ss	n.a.	molten nickel wash
Dust collector cyclone		mild steel	54 days	304 ss	30 months	nickel concentrate fines
Ductwork	dust recovery	mild steel	n.a.	304 ss	n.a.	Ni Sintering
Stacks, exhaust	dust recovery	mild steel	n.a.	304 ss	n.a.	Ni Sintering
Chutes, discharge		mild steel	n.a.	304 ss	n.a.	Ni Sintering
Blowers		n.a.	n.a.	316 ss	satisfactory	pure SO_2
Chute	handling feed	n.a.	n.a.	316 ss	satisfactory	Cu feed
Fan housings, Fan impellers		n.a.	n.a.	316 ss	satisfactory	pure SO_2
Heat exchangers		n.a.	n.a.	316 ss	satisfactory	acid
Piping		n.a.	n.a.	316 ss	satisfactory	acid
Pumps	gas cleaning	n.a.	n.a.	316 ss	satisfactory	10% H_2SO_4, 2% SO_2 15% solids, 140° F
Valves	diaphragm and gate	n.a.	n.a.	316 ss	satisfactory	10% H_2SO_4, 2% SO_2 15% solids, 140° F
Tanks		n.a.	n.a.	316 ss	satisfactory	10% H_2SO_4, 2% SO_2 15% solids, 140° F
Scrubbers	gas cleaning	n.a.	n.a.	316 ss	satisfactory	pure SO_2

Source: Sudbury Area (Canada) Smelters

tanks, heating coils, pumps, valves, stripper plates and other equipment. The austenitic stainless grades, typified by grade 302, are well suited for handling electrolytic solutions.

Acid Resistance. Corrosion rate of sulphuric acid on the stainless steel alloys is well established. The austenitic type 304 tolerates sulphuric acid in concentrations somewhat less than 10% at room temperature. At higher temperatures and concentrations, to restrain corrosion rates on stainless to less than 0.020 in. per year, a recent preference has been type 316. This molybdenum-bearing stainless alloy is normally considered the first choice for metal refining equipment.

In recent years, a modification of type 316 alloy has achieved modest acceptance for highly corrosive service in the chemical process industries. This development alloy, termed D-319, also work well in metal refining.

As shown in Table IV, alloy D-319 may be considered a more precisely alloyed type 316 stainless steel.

Service data on alloy D-319 are few. However, ASME has accepted the development alloy within the framework of its boiler code and pressure piping code. Acceptance recently has been extended to include ASME oil piping standards.

It must not be presumed that stainless D-319 will withstand corrosive environments destructive to stainless type 316. The advantage of D-319 lies in the extension of service life in environments where stainless 316 already enjoys successful use. For example, if type 316 is known to last six years in a given service, alloy D-319 may be expected to add about 10% to equipment life.

Both stainless alloy 316 and D-319 generally are regarded as suitable for sulphuric acid environments at temperatures approaching 200° F. At increasing acid concentrations, corosion resistance of the stainless alloys rapidly decreases until at a 30 to 40% concentration level, solution temperatures higher than ambient may prove detrimental.

Metallic Salt Buffers. Substantially lower corrosion rates of types 304, 316 and D-319 result from addition of an inhibiting agent to the electrolytic bath. In the presence of such metallic salts as copper sulphate, stainless equipment is reported as corroding at rates less than 0.020 in. per year in solution concentrations of 40% and temperatures approaching 100° F. At lesser acid concentrations, alloys 316 and D-319 thus buffered will tolerate temperatures up to 200° F.

For metal refining service more severe than that just cited, certain proprietary stainless alloys have found modest acceptance. These special alloys are said to withstand sulphuric acid in all concentrations at temperatures beyond 150° F.

In designing for refining service, method of equipment fabrication should be considered. Exposure of weldments to certain severe environments may result in intergranular corrosion. Where welds are planned in refining equipment, standard modifications of the preferred alloys may be desirable. Examples are use of type 304L where type 304 would otherwise suffice, or choice of type 316L for welded equipment used in service normally calling for type 316. If facilities permit, heat treatment above 1800° F. will avoid the need for the preceding alloys. Omission of weldments, of course, averts the need for such consideration.

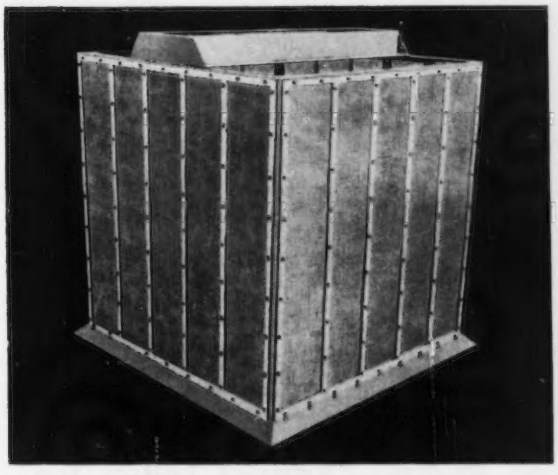
Tankhouse Electrolyte Solution

In the electrolytic refining of copper, not only is the solution vitriolic but it also contains suspended material in some stages. Electrolyte slimes attack metals both by oxidation and by creation of oxygen-depleted localized areas beneath sludge deposits. Galvanic action can result from the latter. Stainless is one of the few construction materials that is reported to resist the combined assault of both forces.

In galvanic corrosion, electrical current flows between the low-oxygen cell and the rest of the part. Magnitude of the current, and seriousness of the pitting, depends on the metal's place in the galvanic series. The pas-

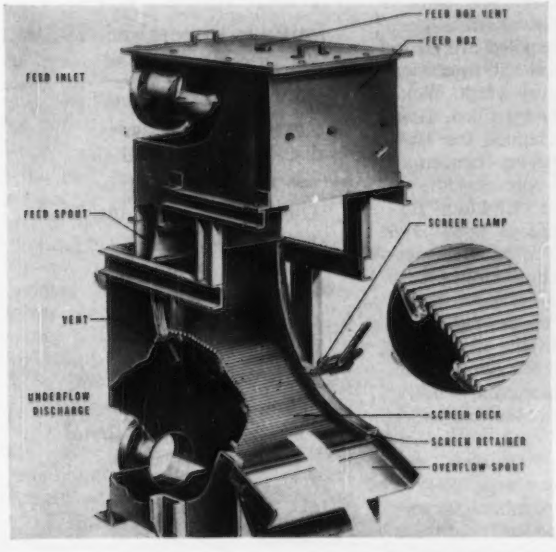
GLAUBER'S SALT is filtered from a corrosive brine on an Oliver stainless steel filter at West End Chemical Co.

A DAMP, CORROSIVE ATMOSPHERE covering a range of 125F° requires stainless on this 750,000 cfm mine fan.



AN H_2SO_4 SLURRY with ammonia salts made stainless mandatory in this ion-exchange basket in uranium acid leach process.

HIGH RESISTANCE to abrasion and corrosion, and a self-cleaning surface at high temperatures are useful properties.



STAINLESS STEEL blades and tanks are used in these drag classifiers at Uranium Reduction Co.

LARGE VOLUMES of abrasive slurry are sharply classified by stainless steel ODS screen. Screen reverses when worn.

sivated stainless surface resists galvanic corrosion more strongly than all but such noble metals as gold and platinum.

Service Installations. Stainless alloys, particularly types 304 and 316, thus find extensive use on the tankhouse stage of electrolytic refining. Cast pumps and valves of certain proprietary stainless alloys are quite generally used.

Tankhouse modernization programs to date have included replacement of low-pressure steam heating coils by stainless steel plate-type coils operating under positive pressures approaching 100 psi. Since 1956, high-pressure type 316 stainless plate coils have undergone extended evaluation at several refineries, including Canadian Copper Refiners, Ltd., of Canada. The latter employs eight circulating systems, using 16 head tanks each with 64 type 316 plate coils.

Within electrolytic tanks, stainless type 304 stars have been installed in the circuit surge tank outlets to minimize turbulence. Each 10-in. dia star, fabricated from ⅛ in. thick stainless plate, is constantly immersed in acid electrolyte.

Anode lining bars ½ x 1 in. cross section are reported to last longer in service tipped at both ends with 6-in. rods of stainless type 304. The alloy was chosen for its corrosion resistance and low magnetic permeability.

Type 304 stainless steel tank siphons, handling electrolyte and slimes, have endured more than six years' service in regular exposure to these corrosive agents. The alloy replaced much heavier siphons of lead and molybdenum-bearing cast steel.

Removal of a 11½x6x2-ft deep lead-lined steel pump tank was required at one location because of excessive abrasion and some corrosion. The replacement was fabricated from type 304 stainless steel plate, and receives slimes and spent solutions as well as tankhouse electrolyte.

Handling Equipment. Intermittent contact with sulphuric acid solution causes failure in most mild steel and wrought iron fasteners and copper anode handling components. For example, exposure to dilute acid-containing washwater brought failure from corrosion in a number of 1-in. dia mild steel bolts securing swivel chains to car pullers. Stainless type 304 bolts now are standard practice. Crane hooks and chains exposed to this environment corrode beyond serviceability when mild steel or wrought iron is specified as the construction material. Bolts, chains and hooks now are type 304 stainless—a standard practice since 1949.

Table IV—Comparison of Stainless Alloys 316 and D-319

Ingredient	Type 316	Type 319
Chromium, pct	16.00–18.00	17.50–19.50
Nickel, pct	10.00–14.00	11.0 –15.0
Carbon, pct	0.08 max	0.07 max
Manganese, pct	2.00 max	2.00 max
Silicon, pct	1.00 max	1.00 max
Phosphorus, pct	0.045 max	0.045 max
Sulfur, pct	0.030 max	0.030 max
Molybdenum, pct	2.00–3.00	2.25–3.00
Iron, pct	balance	balance

Early copper cathodes require regular straightening. This is done by removing from the electrolyte, suspending against the flat surface of a sheet floppers bench, and pounding with wooden mallets. Stainless type 304, 1/16-in. thick, now is employed as the working face of the bench. This material resists corrosion by copper-nickel sulphate, and free sulphuric acid better than the heavier monel working face, which it replaced.

Silver Recovery. In copper refining, slimes withdrawn from the electrolytic tank bottom contain precious metals. To recover silver, slimes are charged to the roaster furnace through type 304 stainless steel chutes. Equipment life is four times longer than the mild steel chutes previously used. Type 316 stainless is used in silver refining for aeration orifice plates that agitate the heavy slurry, for centrifugal baskets, and for slime handling and other equipment.

Parting cells for silver refining frequently are fabricated of stainless, which withstands nitric acid as well as vitriol. Type 304 stainless steel plate, 3/16-in thick, installed at one location in June 1953, is still in service.

In the acid recovery plant, nickel salts are extracted and refined. Also, sulphuric acid is reclaimed for tankhouse electrolyte use by concentration to 67 weight percent. Phelps-Dodge Refining Corp., El Paso, Texas, successfully employs type 316 stainless extensively in this service. Typical examples include atmospheric coolers, crystallizers, hoppers, driers and solution storage tanks in the copper sulphate plant. In the nickel sulphate plant, type 316L is used for storage tanks, evaporators, driers, transfer lines, chutes, bins and other equipment.

Plants for refining selenium and tellurium often employ type 304 or type 316 stainless to minimize corrosion during the precipitation of these materials, and to control abrasion. In grading pure selenium and tellurium, a 200 mesh type 304 stainless steel screen provides greater strength and resistance to corrosion and abrasion than the phosphor-bronze screen previously used.

Zinc Recovery. Various producers, including Bunker Hill Co., Kellogg, Idaho, employ stainless steel widely in zinc refining. One example is use of type 316 for Bird pressure filters in the zinc purification section. These filters previously were lined with copper.

Sheathing. Building construction represents a rapidly growing use of stainless sheet. Where corrosive fumes emitted during milling or refining processes call for stainless equipment, selection of the same alloy for building construction makes good design sense. Peabody Coal Compnay choose stainless type 302 siding to protect the exterior of its coal preparation plant at Freeburg, Ill. The plant crushes, washes, screens and dries coal at the rate of 1,000 tph. Selection of stainless, the firm finds, virtually eliminates structural maintenance and substantially reduces overall plant maintenance costs. Each stainless panel is 34 in. wide, and varies in length from 5 to 12 ft. Sheeting is 0.019 in. thick.

E&MJ's Annual Index for Volume 160

January-December 1959

. . . may be obtained free on request. The index lists the major technical articles and important new items for the year and contains an alphabetical listing of authors.

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MOBILE ORE BRIDGE, with conveyor belt feeding from crushing section, blends ore and feeds onto a 1.3-million metric ton storage pile. Scraper, hung from rail-mounted towers, scoops ore into tunnels where it is conveyed to ore ships.

Orinoco Scraper Speeds Stockpile Feed

C. H. HUBBELL

ORINOCO MINING CO., U.S. Steel Corp. subsidiary, has recently added a new 15-million metric tpy scraper-loader facility at Puerto Ordaz, Venezuela to handle iron ore from its Cerro Bolivar mine, 90 miles away. The ore is brought from Cerro Bolivar by rail to Puerto Ordaz where it is dumped, fed through primary and secondary crushers, and conveyed onto a movable ore bridge spanning a 1.3-million metric ton storage area. The ore is scraped by the new rail-mounted unit into two tunnel conveyors running lengthwise under the storage pile. Ore is then conveyed to the loading dock on the Orinoco River to be discharged into ships which carry it 184 nautical miles down the Orinoco River and to world markets.

A conveyor belt carries ore from the primary and secondary crushers to a second conveyor mounted on the mobile steel bridge shown above. The bridge rides over the stockpile on rails, spreading ore evenly or locating it in specific areas of the stockpile. The blending action of the traveling bridge results in a more uniform analysis on the stockpile and quality control of the shipped product.

The scraper unit is a Sauerman 10-cu yd Cableway DragScraper. It has two self-propelled towers, one on either side of the storage pile. A track cable is suspended between the two towers and a carriage rides on the cable. A fall block is suspended from the carriage by a hoisting line. The scraper is attached to the fall block and is controlled by two haulage lines and a hoist line.

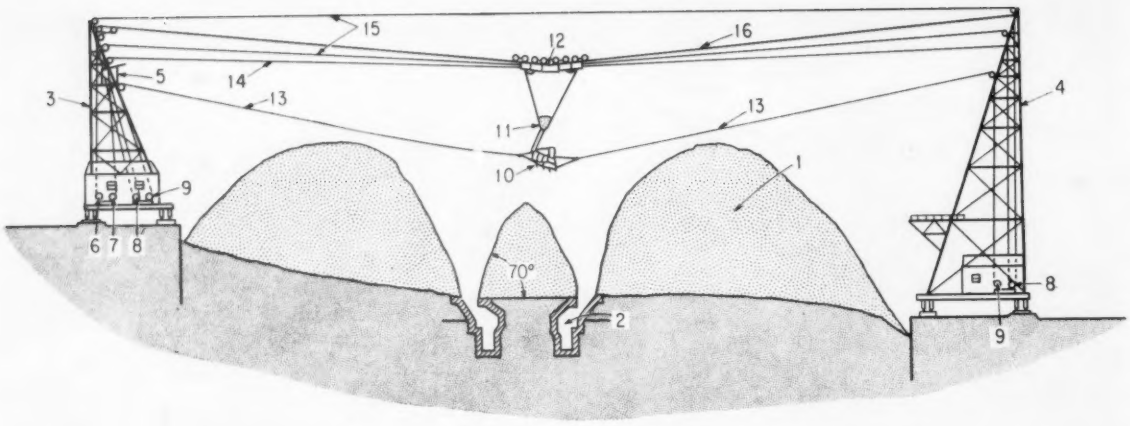
All power for the unit is obtained from a four-wire trolley system, parallel to the tail tower. Current is three-phase, 60 cycle, 4,160 v. One of the four trolley wires is a ground wire. Collector shoes on the tail tower bring power onto the tower. The 4,160-v current is used to power two 300-hp motors and a 150-kva substation on the tail tower. Current is carried over to the head tower by a power cable suspended from a ⅝-in. counterweighted suspender cable. At the head tower the 4,160-v current powers two 300-hp motors and feeds a second 300-kva substation.

Each substation includes a high-voltage air interrupter switch, a transformer for reducing the voltage from 4,160 v to 480 v and a low voltage circuit breaker section including a main breaker and individual breakers for each motor.

The head tower substation also has a breaker for the control circuits which are carried between the towers by two 30-conductor cables suspended from a second ⅝-in. counterweighted cable.

A special integrated control is provided in the cab for the two haulage units to pull the scraper in either direction and to control slack in an overhauled line. When the haulage master switch is in the off position, a slight tension is maintained in the two haulage cables by means of a counter-

Mr. Hubbell has been with Sauerman Bros., Inc. as an engineer for 13 years, and for the past six as chief engineer.



1. Stockpiled ore in the 400x1,000-ft storage area. When ore is piled to 80 ft, capacity is 1.3-million metric tons. Ore is crushed and then laid down in the pile by traveling bridge (see photo). Angle of repose is about 70°.

2. Reclaiming slots contain self-propelled, track mounted rotary plows which feed conveyor belts carrying the mixed ore to ship loading docks.

3. Head tower, 100 ft high propelled by 100-hp wound-rotor motor, controlled from operator's cab in the tower or from the machinery house. Rides on two pairs of track, front set resting on a concrete base, rear set ballasted 40 ft 10½ in. from the front. Traveling bridge also rides on front track. Two four-wheeled trucks at each corner provide support through an equalizing bolster. 30-in. wheels are mounted on vanadium steel axles and cast steel bearings with bronze bushings. Cast steel balls on the bolster rest in cast steel socket on truck frames. One pair of trucks on front and back are powered by the 100-hp engine through gear reducers, spur gearing and counter shafts. Propelling speed is 70 fpm, the same as the traveling bridge. Two-ton jib crane, mounted on top of tower with motorized hoist, is used to raise and lower loads for maintenance purposes. A large machinery house at the base contains haulage, hoisting and propelling machinery and electrical equipment. Floor of the house is reinforced concrete, as is a large counterweight at the rear of the deck which counteracts the cable pull. Total weight of floor and counterweight is 405 tons. Machinery house is ventilated by a 5-hp blower drawing filtered air from outside. A 15-kva transformer furnishes current for lighting and auxiliary use. A dust chute is provided on the roof to confine dust and rain. Three phase, 440v receptacles are provided for plugging in welding machines and 110v plugs are for auxiliary use.

4. Tail tower is 150 ft high, track-mounted and self propelled. Top of tail tower is at same elevation as head tower. Difference in height between the two is due to a difference in base elevations. Tracks and motor for tail tower are similar to those of head tower. Ballasted rear track is 50 ft 10½ in. from concrete-based front track. Shear leg of traveling bridge also uses rear track. Weight of reinforced concrete floor of machinery house and counterweight of tower is 433 tons. A 15-kva transformer, similar to head tower, powers lights. Ventilation and dust chutes are the same as those of head-tower machinery house. Tower also has a jib crane with two-ton hoist at the top and over 150 ft of cable. Platform on tower is used for charging buckets and carriage access. Welding outlets are provided as in head tower.

5. Operator's cab. All controls are grouped in two consoles at either side of the operator with exception of floor-mounted foot switches. Controls include single master switch for the two haulage units; a master switch for the hoisting unit; a single master switch for the two propelling units; transfer switches for passing control to the two machinery houses; a selector switch for operating individual towers when master switch is operated; foot switches to control the haulage and hoisting unit brakes, and other selector switches and push buttons for reeving cables, changing buckets or making adjustments. Telephone and bell systems are provided for communications and signaling. Operator is provided with head-mounted telephone set.

6. Track cable take-up drum, 20-in. dia steel drum with 48-in. gear and clutch. Drum is provided with two heavy duty spring-set, air released band brakes and air released, spring-set pawl for holding the large cable pull of the take-up cable. Clutches and brakes used throughout. Winch is driven by a 150 hp wound-rotor motor coupled to roller chain drive. Same winch operates hoisting drum.

7. Hoisting drum, 36-in. steel grooved drum with 48-in. gear and air-set, spring-released, expanding band clutch. A spring-set air-released, contracting band brake is provided for the drum.

8. Conveying drum, driven by enclosed, single-reducing herringbone reducers from two 720-rpm 300-hp wound-rotor motors, renewable alloy steel spool-type lagging, 54-in. spur gear on which is mounted air-actuated spring-released band-type friction clutch. A spring-set air-released brake is also provided for the drum. Brakes and clutch of unit are remotely controlled by solenoid-actuated air valves. All bearings are of anti-friction type. Conveying drum is driven in conjunction with haulage drum.

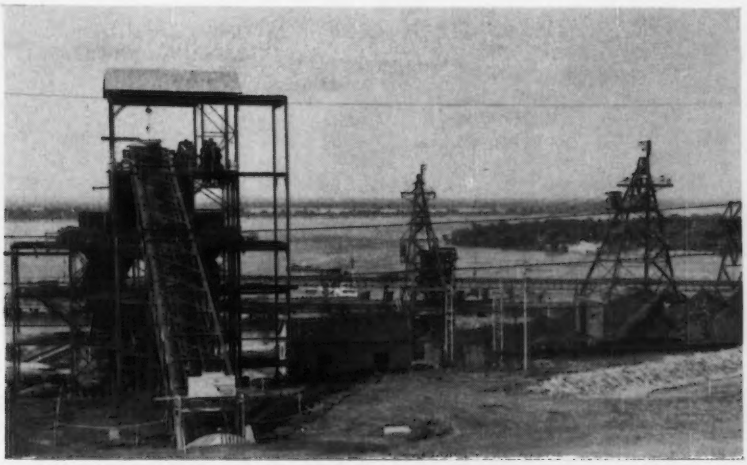
9. Haulage drum, also driven by the two 300 hp motors, that drive conveying drum, is 60-in. dia steel drum grooved for scraper haulage cable. A 72-in. spur drive gear is bolted directly to drum. Drum is provided with a spring-set, air-released contracting band brake. Drum drives small roller chain take-off drive which actuates a geared limit switch to prevent scraper from being brought too close to tower. Drive also actuates a Selsyn transmitter controlling a differential Selsyn in the operator's cab to give him visual measure of motion of head and tail-tower haulage units.

10. DragScraper bucket, two types provided. Sauerman Crescent DragScraper has 10 cu yd capacity, welded rolled-steel body, abrasion-resistant lip and manganese steel teeth and runner shoes. Second bucket is double-ended DragScraper for shuttle operation on ore peaks. Manganese steel chains with case-hardened connecting pins suspend DragScrapers from fall block.

11. Fall block, 36-in. cast steel sheave turning on tapered roller bearings with ring-type grease and dust seals and twin swivel hook with keeper for bucket hanging chains. Block is suspended from traveling carriage.

12. Traveling carriage, two four-wheeled articulated sections with roller-bearing-mounted 30-in. dia wheels; equalized wheel loads. Rides on track cable suspended between two towers.

13. Haulage cables, 1⅝-in. wire center cables, attached to two ends of DragScraper by cast steel wedge sockets. Wedge sockets connected by overhaul cable reeved through sheaves in fall block. Overhaul cable provides connection to haulage cables when bucket chains are disconnected. Haulage cables reeved over 57-in. manganese-steel guide sheaves.



SECONDARY CRUSHER on left is fed by belt conveyor from primary crusher, 140 ft below ground. Dock at junction of Orinoco and Caroni Rivers in rear.

TAIL TOWER guides scraper. Ship channel in rear (E&MJ, July, p 138).

torque in the haulage motors. When the master switch handle is pulled toward the operator, head tower haulage motors pull the scraper toward the head tower and at the same time the tail tower motors pay out cable with reduced torque. On the last point of the master switch, a countertorque is produced in the tail tower motors to brake payout of the cable. When the master switch is returned to the off position, countertorque is again produced in both lines. If the master switch handle is pushed away from the operator, operation is reversed. The degree of torque produced by the motor is changed by connecting the pairs of motors in parallel for high torques and in series for low torques.

In addition to the limit switches on the haulage hoists for limiting scraper travel, other limit switches are also used. Those include switches to stop the towers when they near the ore bridge or approach the ends of the tracks and to prevent excessive misalignment of the towers with respect to each other. The machine was designed for a maximum skew of 5°.

Operation of the scraper and towers is controlled by a single operator in the head-tower cab. However, one or two additional men are used to maintain and inspect the equipment.

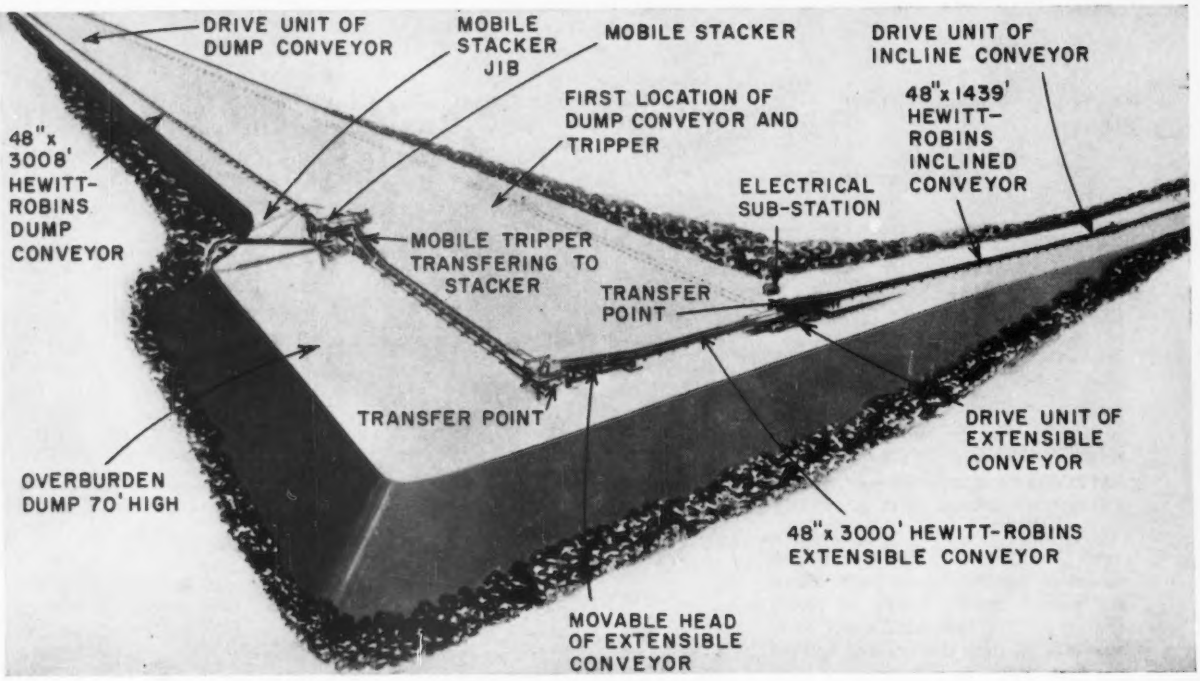
CERRO BOLIVAR IRON MINE is operated around the clock by the Orinoco Mining Co. Cars are direct-loaded at top of pit and by truck at the bottom.

Engineering studies for the new facilities were made by Tippetts-Abbett-McCarthy-Stratton of New York, N.Y. Francis Thomas is president of the Orinoco Mining Co., and J. A. Rooney is vice president in charge of engineering. The special electrical control system was furnished by the General Electric Co. Structural steel was fabricated for the project by the American Bridge Div. of the U.S. Steel Corp.

14. Hoisting cable, 1-in. fiber-center cable, English reeved for two-part hoisting line between carriage and fall block. Cable is dead-ended at tail tower and reeved over 36-in. roller-bearing guide sheave on head tower to hoisting drum.

15. Carriage conveying cables, 1-in. fiber-center, dead-ended at carriage. Cable is reeved over 36-in. guide sheaves in two towers and around spool-type conveying drums. From two conveying drums cable is led back to tops of towers with a free span between them. Cables pull carriage over track cable.

16. Track cable, 2½-in. locked-coil strand, breaking strength of 345 tons. Cable supports traveling carriage. Ends of track cable are zinced to heavy bridge sockets in towers to provide universal connection to accommodate misalignment of towers. Power actuated track cable take-up with nine parts of 1⅛-in. wire-center cable is located at head tower. Two tandem four-sheave take-up blocks are used, each with two 30-in. and two 24-in. bronze-bushed cast-steel sheaves. Short-luff anchor cable is provided to anchor take-up cable drum without lowering track cable.


DRIVE UNIT OF DUMP CONVEYOR
MOBILE STACKER JIB
MOBILE STACKER
DRIVE UNIT OF INCLINE CONVEYOR
FIRST LOCATION OF DUMP CONVEYOR AND TRIPPER
48"x 1439' HEWITT-ROBINS INCLINED CONVEYOR
48"x 3008' HEWITT-ROBINS DUMP CONVEYOR
ELECTRICAL SUB-STATION
MOBILE TRIPPER TRANSFERING TO STACKER
TRANSFER POINT
TRANSFER POINT
DRIVE UNIT OF EXTENSIBLE CONVEYOR
OVERBURDEN DUMP 70' HIGH
48"x 3000' HEWITT-ROBINS EXTENSIBLE CONVEYOR
MOVABLE HEAD OF EXTENSIBLE CONVEYOR

OVERBURDEN from the pit on the right is conveyed by a pit-conveyor system. The pit conveyor transfers its load to level and inclined conveyors. The inclined conveyor loads an extensible conveyor on the dump which transfers to a mobile stacker,

Wheel and Belts Strip Nchanga Pit

THE BUCKET EXCAVATOR used by Nchanga Consolidated Copper Mines Ltd, Northern Rhodesia (E&MJ, February 1959, p 164), to strip overburden at their Nchanga open pit is presently stripping at a rate of nearly 30 tons a minute. The crawler-mounted machine, a modification of the Kolbe bucket excavator in use in the U.S. and Germany, discharges to a pit conveyor which in turn feeds to an extensible 13,000-ft long conveyor system handling up to 3,000 tph at speeds of 800 fpm. Waste is ultimately deflected by a 40-ton self-propelled rail-mounted conveyor tripper to a 380-ton crawler stacker discharging along a 3,000 ft path to build a tailings pile 70 ft high. The dump is planned to contain over 100-million cubic yd of waste. Ore production is about 80,000 tpm and 16,079,000 bank cubic yd (cubic yards in place) have been moved since operation commenced in April 1955.

Nchanga Consolidated operates three orebodies in the area, the Chingola and Nchanga, which are open pit mines, and Nchanga West, which is underground. The Nchanga orebody is covered by about 100 ft of overburden at the apex and plans for stripping include ore with overburden to 800 ft. Below 800 ft the Nchanga open pit will probably switch to underground methods.

When strip mining operations began in 1955, the overburden was excavated by three electric shovels discharging to railway cars drawn by diesel locomotives. As work progressed, engineers started looking for a more efficient and economical method of digging and transporting the material. The decision to use the excavator was made and an Orenstein-Koppel bucket-wheel excavator was built in West Germany and shipped in sections to the Nchanga operation to be assembled at the pit and walked to the floor to start operation.

The big digger weighs 408 tons and stands 75 ft high, walking and eating its way through 86-ft benches under its own power at a top rate of 1,918 tph (roughly one ton every two seconds).

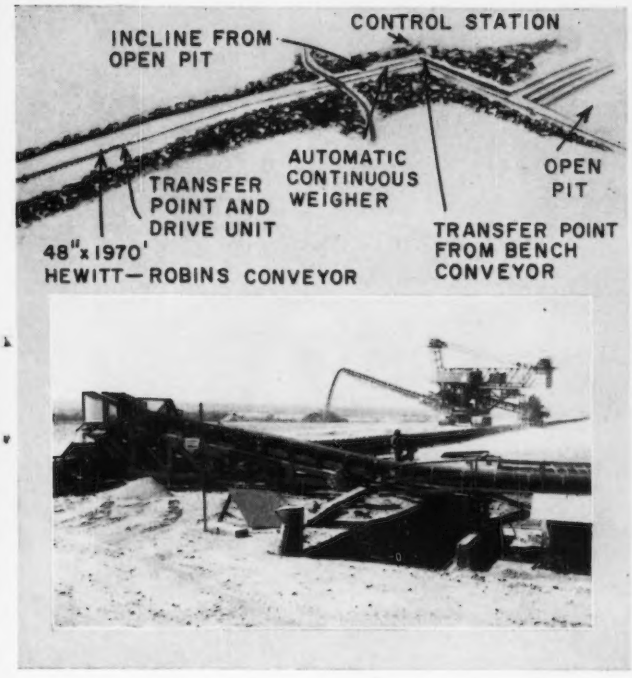
About 500,000 bank cubic yd of overburden are scheduled to be removed every month.

Digging rate for the 20-ft 4-in. dia bucket wheel is dependent on the rate of rotation of the eight 0.45-cubic yd capacity buckets and the type of material being excavated. Under normal operation the Nchanga bucket excavator digs about 1,075 loose cubic yd per hour at a 48 bucket rpm, which is equivalent to 825 bank cubic yd or 1,235 tph. At a speed of 72 buckets per minute the digger will produce 1,600 loose cubic yd per hour or 1,230 bank cubic yd which is 1,835 tons per hour. Under normal operation the unit runs 24 hours per day.

An 86-ft high bank is produced by the machine from four cuts—two high cuts of 41 ft and 12 ft and then two low cuts of 17 ft and 16 ft. The cuts are made with the digger in place and rotating on its axis, cutting a horizontal swath of overburden, then returning with a lower cut. After the 86-ft bank has been cut, the machine and bench conveyor belt is moved to a new position to begin a new bank cut.

The excavator is presently stripping an area in the northern section of the pit, the cuttings traveling through the machine and into a hopper over a bench conveyor at the rear. The bench conveyor is mobile and may be moved in as the bench is widened, or broken down and moved to a new location.

Material from the excavator is automatically dumped into the travel-



building the dump at the rate of 3,000 tph. Ore dump is planned for about 100-million cu yd waste.

Nchanga News, Chingola, Northern Rhodesia

BUCKET WHEEL excavator strips over 30 tons of overburden a minute, discharging through a grizzly onto pit conveyors.

ing hopper which is mounted on rails and straddles the bench conveyor. The Jeffrey-Galion bench conveyor system elevates the material to near surface level and discharges to a permanent overland conveyor system on the tailings dump.

Damage to the bench and overland conveyors from bulky material is eliminated by a mobile grizzly also riding on rails over the bench conveyor.

The second permanent or pit conveyor feeds from the pit onto the tailings dump to a third mobile conveyor at right angles to the pit conveyor. The third conveyor can move sideways to widen the dump laterally as it is extended. The conveyor systems are equipped with 3-pully, 20° idlers.

The conveyor system was designed by Hewitt-Robins' African subsidiary, Robins Conveyors Ltd., in association with engineers of Anglo American Corp. and the Nchanga mine. The conveyor machinery was manufactured in the Robins Conveyors' plant in Johannesburg.

At the discharge point of the overland conveyors, a 40-ton self-propelled Robins Conveyor tripper deflects the material to the 380-ton stacker. The stacker, 66 ft high and 250 ft long with its boom extended, moves forward and backward along a 3,000-ft path, building a stockpile 70 ft high. The dump is planned to have an ultimate capacity of 100-million cubic yd of waste.

When the conveyors were put into operation, the pit was 4,000x1000x 140 ft deep. Since that time, the mine has grown steadily in size. Eventually it will measure 4,200x2,600x800 ft. About 16,079,000 bank cubic yd have been removed since operations commenced in April 1955 with 1,489,000 tons milled and 2,055,000 tons of ore stockpiled. The ore averages 3.6% copper.

Many of the design principles used at Nchanga were first worked out from experience with the earlier bucket-wheel excavators in the U.S. One of the first problems encountered with the Kolbe digging wheels, when the design was put into operation at the Cuba mine in Illinois, was that speed of the digging buckets was so great that wet material hung up and failed to discharge properly.

The problem was eliminated by substituting heavy chain for the solid bucket bottom. When the bucket dumped, the chains whipped back into the bucket knocking loose the sticky material.

A second problem attendant to high speed digging operations is rapid removal of the material to the dump The first Kolbe wheel used at the Cuba mine had digging rates of 1,000 cubic yd per hour and the fourth and latest model excavates at 3,500 cubic yd per hour with a maximum theoretical speed of 8,400 cubic yd per hour. Belt speeds on the original system were over 600 fpm and the present ladder belt runs at 910 fpm. The stacker belt has a top speed of 1,225 fpm. High belt speeds cut down belt width and the weight and bulk of conveyor and supporting structures.

Nchanga engineers designed their belt system with these design principles in mind. The belt system is further designed to increase in speed at each transfer so that material discharging at the end of the conveyor is thrown far enough to build a broad dump area before the stacker is moved.

The belt system on any Kolbe type digger will take a beating because there is little control of material size handled.

These problems were originally solved at the Cuba mine by using a smaller tail pulley. The smaller pulley, cutting the drop at transfer points, reduced loading shock and allowed higher belt speeds.

In the early belts, considerable damage to idlers resulted from the belt bucking as it was loaded when traveling at high speeds. The Cuba mine handled the problem by building special suspension idlers for the job. Nchanga followed through with a similar design. Suspension idlers at the Illinois coal mine are held on a rubber cushion at each end.

(*Continued on p 112*)

SANDS of glass-making quality occur in the lower member of the Baseline formation (Upper Cretaceous) as the remnants of ancient beach deposits well washed by waves to remove much of the soluble iron content. Sandstone is friable.

Simplot Washes High-Grade Glass Sand

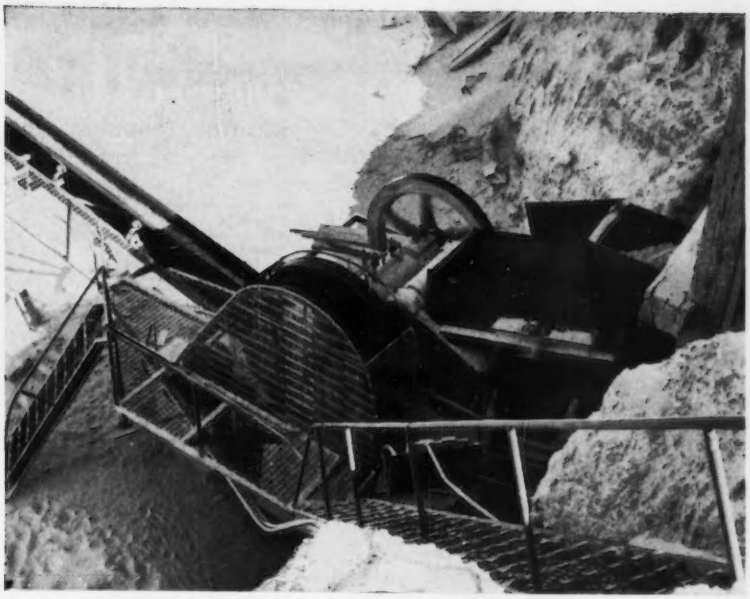
JOHN B. HUTTL

WASHED GLASS SAND, 99.4% silica and a washed foundry sand almost as pure are being produced at the rate of 300 to 350 tpd by Simplot Silica Products, Inc. from their deposit in Clark County, Nevada's silica sand producing center. Operations cover drilling, blasting, open pit mining, washing, screening and drying with a working force of 21 men headed by Keith Madill, general manager.

Open pit mining operations carried on since 1938 in the Kaolin Wash area near Overton, Clark County, Nev. by W. R. Crozart, first owner of the property; the Nunn Co., subsequent lessee; and Simplot Silica Products, Inc, owner and operator since 1955, have already yielded more than 1.3-million tons of friable silica sandstone, from which some 1,115,000 tons of diverse finished products have been processed and sold in western markets. Overton is a small farming community in the Muddy River Valley, and the hub of and chief supplier of labor to the near-by mining district which furnishes the bulk of Nevada's annual silica sand output. It can be reached by car from Las Vegas via U.S. Highways 91 and 93 and Nevada Highway 12 branching off at Glendale and running southeasterly to the north shore recreational areas of Lake Mead.

The mineral holding in the district controlled by Simplot consist of 1,245 acres in Sec. 3 and 11, T. 17 S., R. 67 E. Sand processing facilities comprise a scalping plant 1¼ mile from the present pit, and a washing plant two miles south of Overton served by a branchline of the Union Pacific R. R. Current sand production is obtained from a pit started by Simplot in February 1955, in the south fork of Kaolin Wash about 3,000 ft northwest of the old pit formerly operated by the Nunn Co. and closed by Simplot because the overburden to sand ratio became excessive. The material mined is friable, with well-rounded grains largely free of fractures. About 65

INCLINED CONVEYOR transports minus 2-in. feed from crusher to a 4x8-ft single-deck screen on top of the storage bin. Note 22-ton White at right.

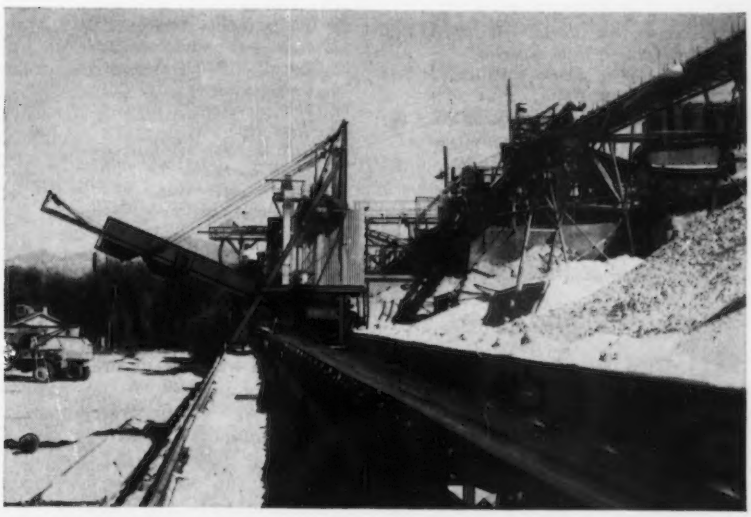


RUN-OF-MINE sandstone is broken to minus 2 in. at the scalping plant in an Allis-Chalmers Mfg. Co. 12x18-in. jaw crusher. Revolving grizzly feeds the crusher.

From Nevada Sandstone

to 70% of the grains are minus 50 plus 100 mesh. Finished sand has consistently run 0.05% Fe_2O_3, with Al_2O_3 being the chief contaminant. Washing plant products include sands for use in glass manufacture, foundries, chemicals, and others.

The geology of the immediate mine area is relatively simple. According to S. A. Robinson, Simplot geologist, upper Cretaceous beds of the Baseline sandstone strike N 40° W and dip 25 to 40° to the northeast. The formation consists of poorly cemented white to gray sandstone several hundred feet thick, which grades upward into red sandstone and beds of conglomerate, the whole formation measuring more than 3,000 ft in the type section in and near the Baseline Wash. It is largely reworked sand from the red Aztec sandstone of Jurassic age reports state.



LOADING TOWER that operates between the drying platform and the dryer loads into trucks or railcars, or moves sand to the dryer and from the dried sand bin.

Overlying the Baseline sandstone with a strong angular conformity are nearly flat-lying beds of the Muddy Creek formation, probably of Miocene age. These have been removed by erosion over about half the area on the Simplot property, and reach a maximum thickness of 90 ft just west of the present pit.

Sands of glass-making quality occur in the lower member of the Baseline sandstone and are exposed from the U.S. Silica Co. working near the center of Sec. 12, T. 17 S., R. 67 E. on the southeast, across the old Nunn pit in Sec. 11, an on across Kaolin Wash into Sec. 3, T. 17 S., R. 67 E., covering an over-all distance of nearly two miles. The zone of glass quality sand trends about N. 75° W., and crosses the bedding planes at an angle of some 35°, the glass sand appearing stratigraphically higher from northwest to southeast.

Belief is that the present glass sands are an old beach deposit, where washing by wave action removed most of the iron oxide coating from the sand grains. A receding sea caused the washed and sorted sands of the lower member of the Baseline to be covered by coarser material containing red stains and numerous conglomerate lenses. Down dip the lower member of the Baseline grades into gray to buff clays of the Willow Tank formation of Upper Cretaceous age.

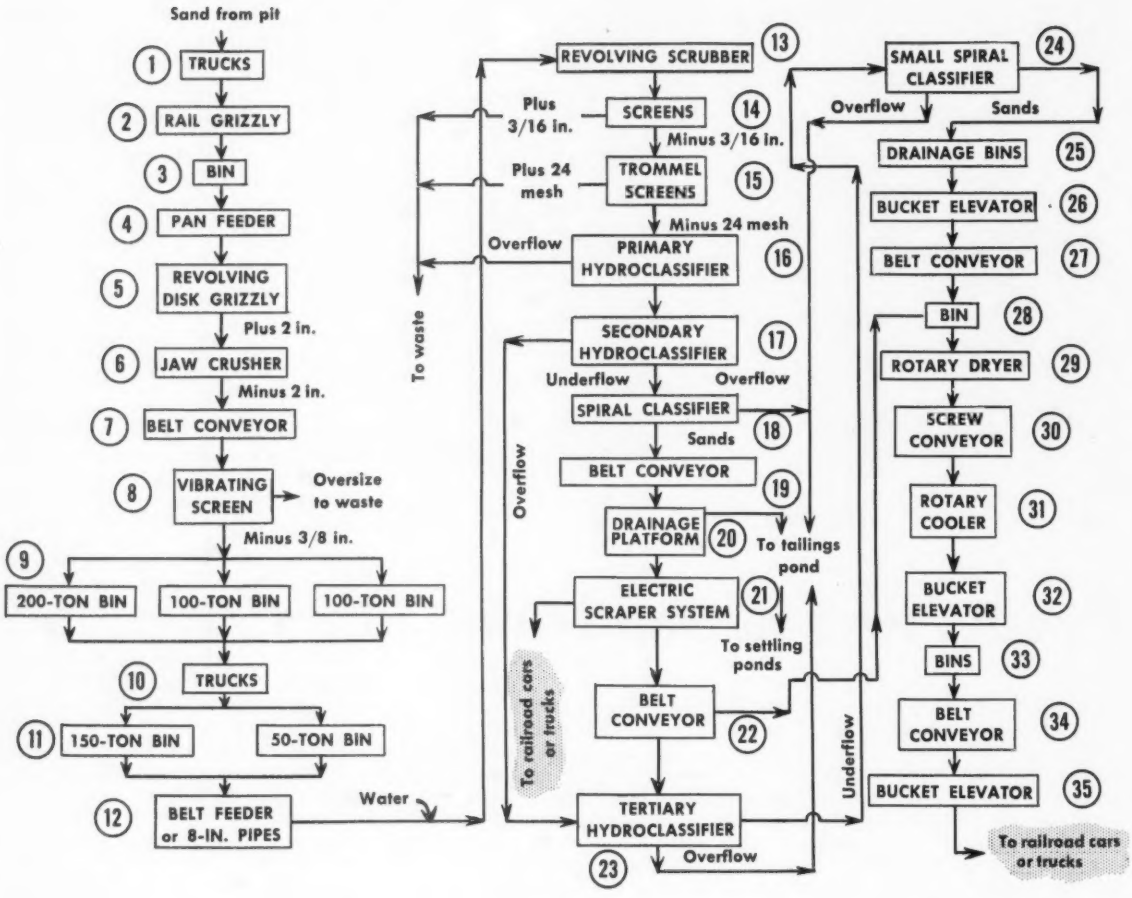
Drilling Established Pit Site

Establishment of the present pit was preceded by a comprehensive rotary drilling campaign to determine the extent of the selected area under consideration, possible tonnage, and quality of the sands contained therein. Seven drill holes ranging in depth from 188 to 355 ft were put down about 800 ft apart along the strike and 300 ft apart across the strike of the sandstone. Drill-cutting samples collected at 15-ft intervals and a channel cut from northeast to southwest across the glass sand zone where it was exposed in the main fork of Kaolin Wash indicated that the sand available in the area explored was as favorable as that in the old pit area and with relatively little overburden. As a consequence, a new haulage road was built from the screening plant to the new pit site. Actual mining in the new pit in the south fork of Kaolin Wash commenced early in March 1958.

The operations carried on in this pit follow more or less standard open pit mining practice. The sandstone face

Glass Sand Washing Flowsheet

Simplot Silica Products, Inc., Overton, Clark County, Nev.

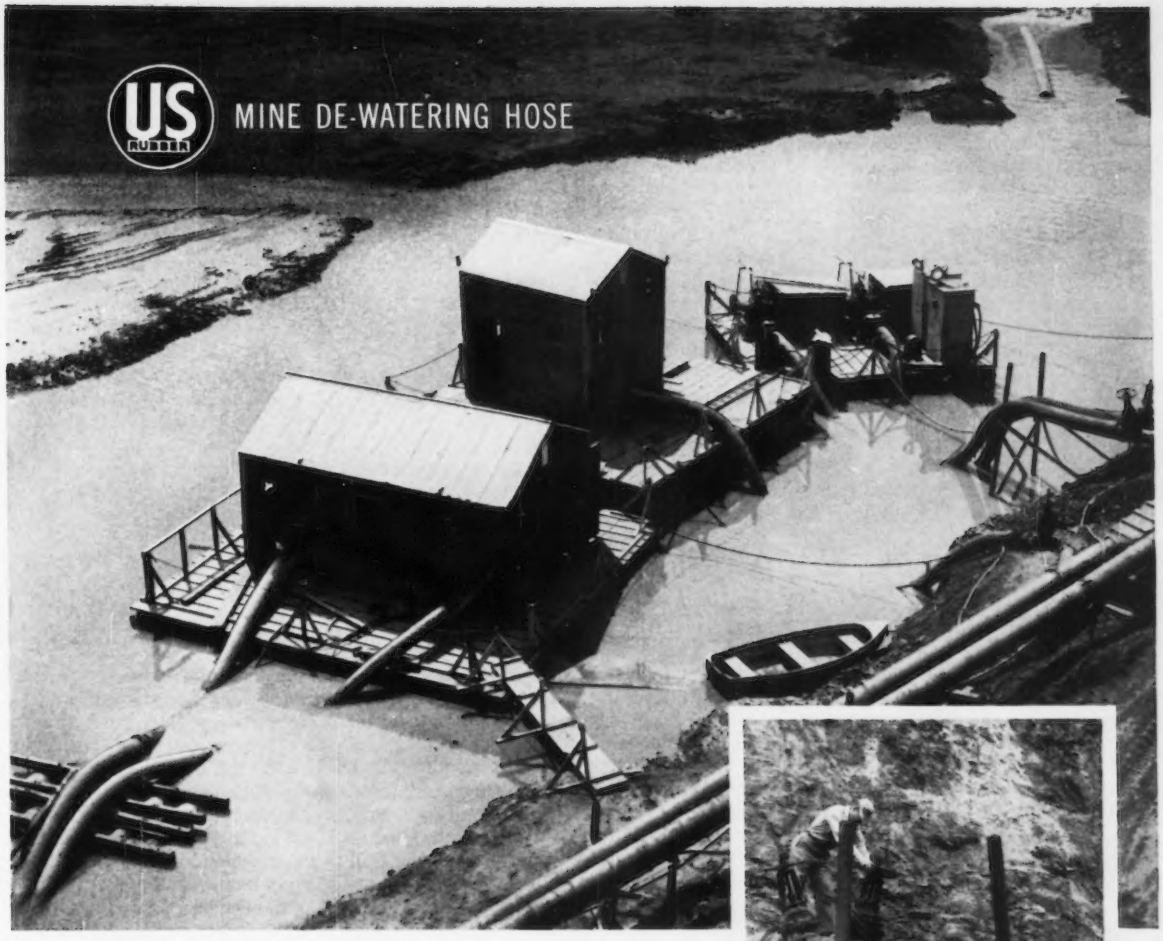


LEGEND

1. Two 15-yd Euclid end-dump trucks
2. Rail grizzly, 10-in. spacing
3. Feed bin, 50 ton
4. Pan feeder
5. Revolving disk grizzly, 2-in. spacing
6. Jaw crusher, Allis-Chalmers, 18x30 in.
7. Belt conveyor, 93 ft long
8. Single deck 4x8-ft Overstrom vibrating screen, ⅜-in. openings
9. Three circular steel storage bins. Total capacity is 400 tons
10. Two 22-ton White propane-powered semi-trailer trucks
11. Two storage bins. Total capacity is 200 tons
12. Belt feeder or 8-in. pipe lines
13. Revolving scrubber, 5x25 ft
14. Two screens to separate minus 3/16 from plus 3/16-in. material
15. Two 6x4-ft trommel screens covered with 24-mesh cloth
16. 3x10-ft primary hydroclassifier
17. Two 2x8-ft secondary hydroclassifiers
18. 3x16-ft Wemco spiral classifier
19. Belt conveyor
20. Drainage platform, 100x300 ft
21. Electric scraper system to load railroad cars or trucks
22. Belt conveyor, 170 ft long, for transferring drained sand to the dryer department
23. 2x8-ft tertiary hydroclassifier
24. Small Wemco spiral classifier
25. Two 15- 150-ton drainage bins
26. Bucket elevator
27. Belt conveyor
28. Dryer feed bin
29. 6x30-ft rotary oil-fired dryer
30. Screw conveyor
31. 4x16-ft rotary cooler
32. Bucket elevator
33. Storage bins
34. Belt conveyor
35. Bucket elevator

is exposed some 500 ft along the wash, and averages 90 ft in height. Overburden is practically non-existant. Some of the residual nodules found are removed by hand before the sand stone is blasted. Blastholes are drilled with a truck-mounted BHDC Portadrill using 3⅞-in. bits. Enough holes, usually from 30 to 50, are drilled and blasted at one time to provide feed for the washing plant for at least six months. Drilling, therefore, is periodic, and the drill is on loan from the company's exploration department. Footage drilled per shift is about 500 ft. When the Portadrill unit is not available and drilling is required, an Ingersoll-Rand Co. Model DA wagon drill with 2¼-in. drills is used.

The large blastholes are spaced 14x14 ft, with the first row about 20 ft back from the face. Depth drilled varies from 90 to 100 ft, depending on the height of the face. Wagon drill holes are 12 ft apart in both directions. Depth is 24 ft. Explosive load of each 3⅞-in. blasthole consists



Withstands high pressures to keep the crushing plant working

The crushing plant, located in the pit area of one of the world's largest metal mines, must be kept *dry* despite frequent, heavy rains. To do this requires an average pumping output of 7,500 gallons per minute, using "U.S." wirecord-built Mine De-Watering Hose.

This hose is mounted on floating rafts, where its extreme flexibility allows it to rise and fall with the water. Yet despite its flexibility, it withstands pressures up to 350 lbs.—as compared with the 250-lb. top pressures of conventional fabric-built hose.

U.S. Mine De-Watering Hose is the one sure way of controlling subterranean streams within the mine, as well as controlling heavy rains and snows that could cause floods and work stoppage. The dependable stamina of this hose is one reason why U.S. Rubber is the largest manufacturer of the widest range of industrial rubber products serving industry.

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of four sticks of 1⅛x8-in, 40% gelatin dynamite at the bottom of the hole, followed by a solid column to almost the top of the hole of 65% free-running powder received in 25-lb bags. The loaded hole series is detonated with Primacord and an electric blasting cap. Powder consumption averages 1 lb for three tons of broken sand, and cost for drilling and blasting is 7c per ton. The sandstone breaks well. Little secondary blasting is required.

Material blasted down from the face is loaded into 15-yd Euclid trucks of the end-dump type by a ¾-yd Koehring electric shovel for transportation to the scalping plant about 1¼ mile distant. Payload moved per 8-hour shift with two trucks employed averages 550 tons. A typical screen analysis of the sand mined is 0.6% plus 30 mesh, 15.9% plus 50 mesh and 6.1% minus 200 mesh.

Novel Revolving Grizzly

As seen in the flowsheet, treatment at the scalping plant involves reduction of mine-run material to minus 2 in. followed by screening to remove waste matter. The trucks dump their sand load into a 12x12-ft sloping-bottom feed bin covered by a rail grizzly. From here, the material is passed via a short pan feeder to a revolving grizzly of novel design and driven by a 3-hp motor ahead of the jaw crusher. The unit shown was designed and made at the plant shops. It consists of 12 parabolic steel disks made from ¼-in. steel, hard-faced at the edge, and spaced on the shaft at 2-in. intervals. They are positioned eccentrically on the shaft. Oversize from the revolving grizzly falls direct into an Allis-Chalmers jaw crusher, while the minus 2-in. undersize is transported to a single-deck, 4x8-ft Overstrom vibrating screen with ⅜-in. openings by a 16-in. belt conveyor 93 ft long.

This unit removes waste matter consisting chiefly of clay and iron-rich nodules and amounting to about 16% of the total screen feed. The undersize goes via a 40-ft cross conveyor to any of the three storage bins it serves. One bin has a capacity of 200 tons, and the other two 100 tons each. The screen oversize mentioned goes to a 25-ton storage bin, whence it is hauled away by trucks returning to the pit.

Screened material stored in the three bins is hauled to the 150-ton and 50-ton storage bins at the head of the washing plant in two 22-ton White propane-powered semi-trailer trucks. Haulage distance is 3¼ mile, and the grade of the well-maintained and wide haulage road 2% in favor of the loaded truck.

At the washing plant, the scalped material undergoes scrubbing, classifying, drainage and drying. Procedure is simple. The material in the storage bins is fed either by belt or hydraulically through 8-in. pipes to a 5x25-ft revolving scrubber with two screens at the discharge end to separate the minus $\frac{3}{16}$-in. from the plus $\frac{3}{16}$-in. scrubbed product. Minus $\frac{3}{16}$-in. material is troughed to the interior of two 6x4-ft revolving trommels covered with 24-mesh screens. The undersize washed through the screens is directed to a 3x10-ft hydroclassifier for additional treatment. Oversizes from the primary and secondary screens go to the waste circuit.

Underflow from the hydroclassifier is re-treated in two 2x8-ft secondary hydroclassifiers which in turn discharge their underflows into a 3x16-ft Wemco spiral classifier. Sand produced by this unit are belt-conveyed direct to the 100x300-ft drying platform. The overflows from the two secondary hydroclassifiers are pumped to a 2x8-ft tertiary hydroclassifier, the overflow from this unit, together with that from the spiral classifier, going to the tailings pond, and the underflow to a small Wemco screw classifier for removal of additional sand. Overflow from this unit joins that of the other classifiers directed to the tailings pond, while the sands go to the drainage bins ahead of an oil-fired dryer.

A Wood and Rock Drainage Pad

Washed sands stored on the drainage platform mentioned drain to a moisture content of about 3%. Construction of the drainage platform resembles that of a leaching tank or vat. As built, it consists of a wooden floor made up of 2x6-in. redwood planks set on edge and spaced at narrow intervals on which is first placed a layer of coarse rock and then a layer of sand. Perforated drainage tile laid beneath the redwood floor collects the water that has seeped through the rock and sand layers and directs it to the settling ponds.

If sand of lower moisture content is desired, then the material stored on the drainage platform is scraped onto a 170-ft belt conveyor system by an electric scraper installation for transportation to the storage bin ahead of the dryer department. Here, the sand is successively passed through a 6x30-ft rotary, oil-fired dryer; screw conveyor; and 4x16-ft rotary cooler. The cooled sand, containing less than 1% moisture and weighing from 90 to 92 lb per cu ft, is loaded by belt conveyor and bucket elevator.

To provide a molding sand for consumers who prefer a product containing a larger proportion of coarse sizes rather than a low iron content, the company mines a red, iron-stained sand-gravel deposit in Kaolin Wash less than 2 miles from the washing plant. Here overburden and vegetable growth are stripped with a bulldozer, with the sand bed proper about 20 ft thick mined and transported to a portable screening plant by a 1⅝-yd Scoopmobile. Plant equipment includes a bar grizzly with 2-in. openings, and a double-deck vibrating screen, with top screen containing ¾-in. openings and the bottom screen ¼-in. openings. The minus ¼-in. product is trucked to the washing plant where it undergoes the same treatment as that given glass sand.

Washed white or glass sand averages 99.4% silica; 0.045% iron oxide; and 0.555% aluminum and titanium oxide. Average screen analysis is 100% through 20 mesh, not over 20% minus 100 mesh, and not over 5% minus 140 mesh.

The foundry sand contains from 98.6 to 99.4% silica and is higher in iron oxide than the glass sand. Fine sand recovered from the tertiary hydroclassifier handling the overflows from the primary and secondary hydraulic classifiers indicated in the flowsheet is 90% through minus 100 mesh. Daily pit production averages 550 tons of glass sand, yielding from 300 to 350 tons of finished products. In general, 40% of the total production is shipped to glass manufacturers; 40% to foundries; and 20% for chemical and special uses.

Power and Water

Electric power is obtained from REA which purchases it from the Hoover Dam hydroelectric plant and from the Southern Nevada Power Co. Power requirements run about 55,000 kwh per month. The Moapa Valley Irrigation Co. and two wells supply water requirements. Half of the water used in the mill circuit is that reclaimed from the tailings ponds after rerouting through four settling ponds. Total number of employees is 21. These work from 5 to 7 days a week, and the average wage paid is $2.35 per hr.

E&MJ expresses its thanks to Keith Madill, general manager, Simplot Silica Products, Inc., and to Donald Ferguson, assistant manager, for the many courtesies extended during the recent trip to the pit and mill. Members of the operating staff include Leo Sneed, foreman; Orson Johnson, head of mill operations; and Patricia Harris, office manager.

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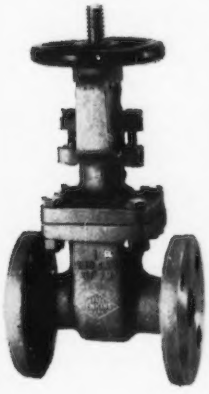

Most of the alloy specs were developed to meet certain highly specialized and rather uncommon needs. Only 1 out of 100 valve users can make practical use of many of the alloys. *Actually, just two or three of the different available alloys will give a big majority of valve users all they want and need.*

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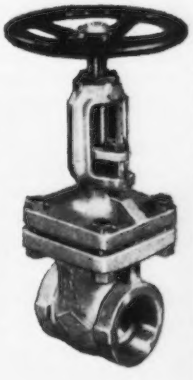

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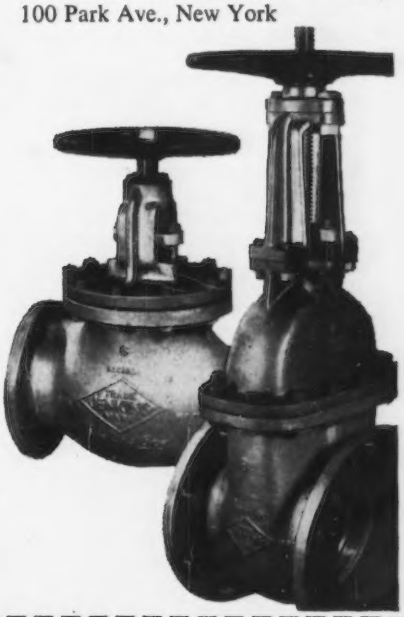

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Mining Practice, Processes & Patents

A roundup on what's being written and said, the patents granted, the techniques tried in the mines, mills and smelters.

Columbia Iron Depends on Diesel Power

SINCE GOING on the line in 1949, three diesel engines have chalked up nearly 150,000 hours and have been available for more than 98% of the time at Columbia Iron Mining Co., Cedar City, Utah. The key to this performance has been the comprehensive maintenance schedule maintained by J. R. Strate, maintenance superintendent of the power plant.

Ten years ago, Columbia Iron, a subsidiary of U.S. Steel Corp., placed into service a new diesel engine power plant at its open pit mines to supply power for expanding operations. The company's electrical engineers, knowing the severity of the electrical load—which varies from 0 to 850 kw, down to 250 kw, up to 600 kw, down to 200 kw and up to 1200 kw, all in a matter of seconds—determined that the most suitable primary power source for the electric shovels, churn drills and other electrical mining equipment would be diesel engines.

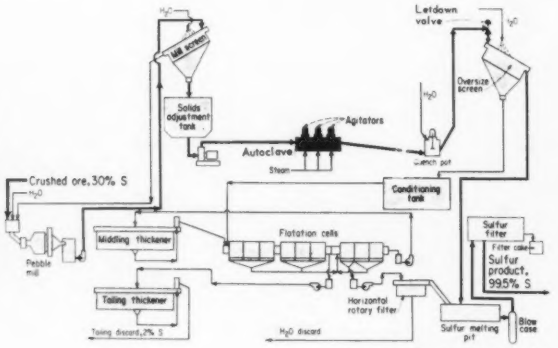
A study was made of heavy-duty, stationary diesel engines and the decision was made to purchase three Worthington Corp. 8-cylinder, 4-cycle, supercharged 600-rpm diesels. Each engine develops 710 kw of full load rating, continuously, at an elevation of 6500 ft above sea level.

The first seven years of operation the running-plant-capacity-factor (the average if expressed as a percentage of the full-load rating) was 57%. During the past year this factor has increased to 60.5%. The three engines have been operating almost continuously because of the fluctuating nature of the load.

Every two years the engines are scheduled for a general overhaul if the condition of the engines requires. The last general overhaul was in October 1956, and the next one was scheduled for this fall. The top compression piston rings have been replaced at each general overhaul and all of the piston rings were replaced during the last general overhaul. Since the plant was started, only one liner has had to be replaced.

Solvent Extraction Process Cost Cutter

Barren solution from the solvent extraction circuit can be used to replace the water normally consumed in countercurrent washing of the leached pulp in uranium mills according to tests conducted at the U.S. Bureau of Mines Salt Lake City, Utah station. Method saves on water requirements and reduces the amount of slimes discharged.



Courtesy Chemical Engineering

Hot Water Separates Volcanic Sulphur

CONTINUOUS autoclaves are being used to win sulphur from low-grade volcanic ores at Volcan Overo, Argentina, using a process devised by Chemical Construction Corp. Process illustrated in the flowsheet above was first piloted at Cali, Colombia. In the new Argentina plant, 208 tpd of ore are treated to recover 90% of the sulphur, 99.5% pure S at 50 tpd. According to CHEMICAL ENGINEERING, Oct. 5, 1959, p 54, Chemico feels that the process would be economic in the U.S. at 100 tpd output. Ore is crushed in two stages to minus 28 mesh, then fed to the autoclaves as a 30% solids slurry. At 266° F and 55 psi (with steam) the sulphur melts and agglomerates. Hot slurry is quenched and screened at 28 mesh to reclaim the sulphur globules (about one half of the contained sulphur as 98% material). This material is filtered and cast as 99.5% S.

Underflow from the screens is floated to recover a 93% S concentrated which is filtered to 99.5% S. Liquid sulphur filter cake is ground and sent back to the autoclaves, since it runs about 50% S.

Solvents Extract Molybdenum For Analysis

THE MOLYBDENUM ION, reduced by stannous chloride and hydrazine sulphate, forms a complex with thiocyanate which can be extracted with these organic solvents for microquantitative determination: ethyl, butyl and amyl acetate; isobutyl, isoamyl alcohol; ethyl acetate in chloroform or carbon tetrachloride; and isobutyl alcohol in carbon tet. The method was investigated and reported by Hidehiro Goto and Shigero Ikeda in SCIENCE REPORTS of the Research Institute, Tohoku University, Series A, Vol II, No. 4. Optimum recovery was obtained in 0.9 to 1.0 N HCl solution when using tin chloride and 0.8 to 1.2 H_2SO_4 when using hydrazine.

Low-Caustic Leach Beats Siliceous Bauxite

HANDLING the very high phosphorus and silica content of wavellite-type bauxites such as those found in Arkansas may have been solved by an ingenious leaching step suggested by John L. Porter, Kaiser Aluminum & Chemical

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Corp., Baton Rouge, La. Porter, now stationed on the West Coast, by preparing insoluble calcium aluminate from spent process liqour (which contains dissolved sodium aluminate) and adding the slurry to pregnant green liquor, precipitated all (or nearly all) of the phosphorus content and dissolved more than 75% of the available aluminum. At the same time, the step avoided excess formation of sodium aluminate (which is lost in the Bayer process tails). According to U.S. patent No. 2,903,338, the low-caustic concentration is the key to the successful removal of the phosphorus while holding down the production of the silicate. Kaiser officials state that the patent does not apply to the present Baton Rouge alumina flowsheet.

Aluminum-Copper Alloy Yields Tantalum

MOLTEN ALUMINUM and copper chloride or molten aluminum-copper alloy will react with alkali tantalum fluorides or tantalum oxides to yield tantalum in pure form. After casting as a copper ingot, the tantalum powder can be recovered by leaching away the copper with a mineral acid, according to Donald F. Taylor, Robert L. Baughmann and Leonard F. Yutema, Fansteel Metallurgical Corp. in U.S. patents No. 2,905,548-9-50. No. 2,905,550 says that columbium, molybdenum and tungsten can be produced the same way. No. 2,905,549 employs silver and gold, not copper. Patent No. 2,905,548 covers the use of copper-aluminum alloy in a one-step process rather than the two-step of No. 2,905,550.

Additional U.S., Canadian and British Patents Briefly Noted

Patent information is provided E&MJ by Oliver S. North, patent consultant, Washington, D. C. Mr. North also scans and abstracts the patents issue in Canada and Great Britain which appear below and which will appear in forthcoming issues of E&MJ. U.S. patents may be obtained from the Commissioners of Patents, Washington 25, D. C. (25¢ each); British patents from the Patent Office, London; and Canadian from the Patent Office, Ottawa.

Recent U.S. Patent Releases

Safe and simple chute blasting aid and method (R. F. Welsh, Jr., assigned to E. I. du Pont) . . 2,911,910
Centrifugal concentrator (C. L. Duesling) . . . 2,909,283
Pelletizing method (Reserve Mining Co.) 2,909,303
Refining cobalt (International Nickel Co.) . . . 2,909,408
Smelting columbite (Vanadium Corp.) 2,909,247
Smelting ores to recover sulphur, sulphates and oxides (Duisberger Kupferhuette) 2,910,348
Using magnetism to contain fine iron ore during sintering process (C. A. Long, Jr.) 2,911,296
Reduction and desulphurization of iron ore pellets with lime materials at 1,200 deg C (National Lead Co.) 2,912,319
Extraction titanium from ilmenite with fluid bed and nitric acid leach (Crucible Steel Co.) . . . 2,912,320
Separating columbium from tantalum by reducing columbium to metal with carbon, then subjecting the reduced mass to fused salt electrolysis to deposit columbium at the cathode (M. A. Steinberg, U.S. AEC) 2,913,379
Handling green pellets (K. Meyer, Dravo Corp.) 2,913,761
Device for sizing green pellets (W. S. Tyler Co.) 2,914,177
Producing zirconium tetrachloride from zircon sands directly (Metal & Thermit Corp.) 2,914,379
Recovering rutile from massive ilmenite through HCl digestion (Horizons Inc.) 2,914,381
Briquetting process (H. Dohmen) 2,914,394
Using lime to improve iron ore sinter or pellets (W. Davies, U.S. Steel Corp.) 2,914,395

These U.S. Patents Have Expired

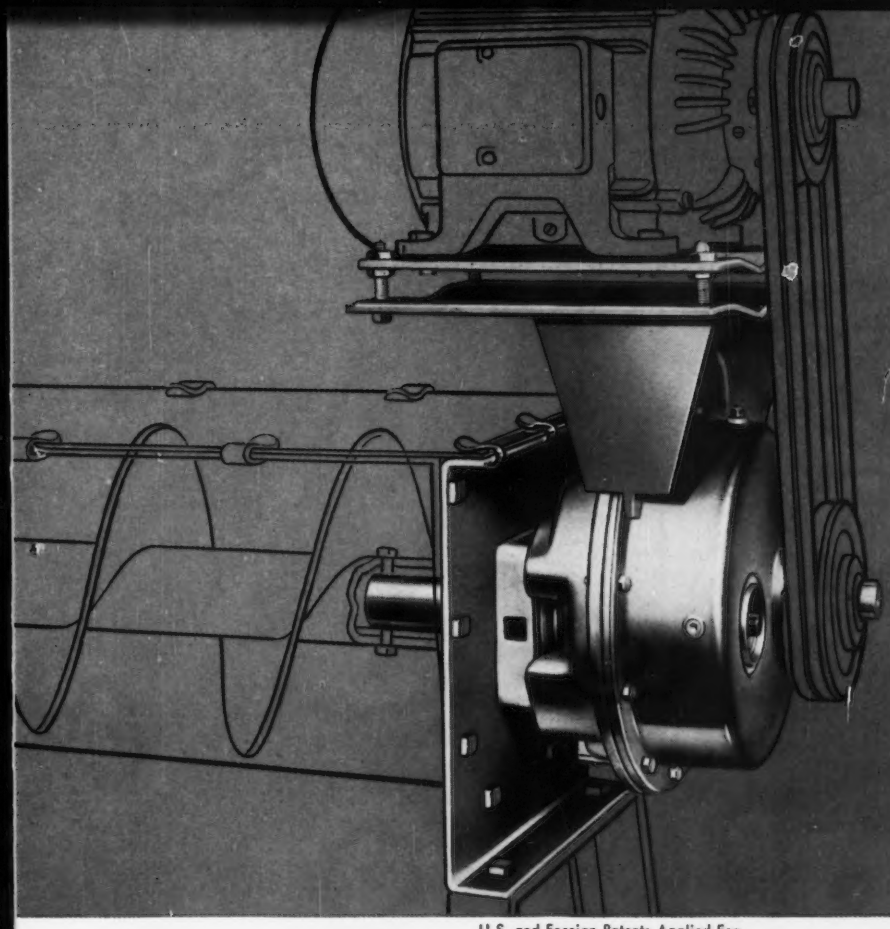
Upgrading ferrous ores (R. L. Patterson) 2,307,064
Floating silica from nonmetallics (American Cyanamid Co.) 2,307,397
Direct reduction of iron ore (G. D. Dill) 2,307,997
Improving open hearth lump-grade iron ore with ground limestone (Bethlehem Steel Co.) 2,308,984
Jigging method for hematite (C. H. Remer) . . . 2,309,275

What's New in Canadian Patents

Device for drilling a curved hole from a main drill hole so that branch holes may be drilled from the same parent hole (V. Thompson) 584,356
Caustic wash to improve settling characteristic of inland ilmenite sands (E. I. du Pont) 584,699
Sample splitter (Reserve Mining Co.) 585,193
Western red cedar wood extract (with or without goulac) is used to improve Betts Process electrolysis of lead (G. H. Turner, Cominco) 584,176
Mineral acid leach at low pH to control iron and aluminum elimination (Sherritt Gordon Mines Ltd.) . . . 584,250
Sherritt Gordon process for treating matte to recover nonferrous metals 584,305
Ion exchange and hydrogen reduction to win copper and/or silver. Patent cites tests on malachite and Pachuca ore. (Sherritt Gordon Mines Ltd.) 584,315
A polyoxyalkylene ether of an aliphatic polyhydric alcohol frother for chalcocite and sphalerite-galena (Atlas Powder Co.) 584,317
Acid decomposition of high-silica aluminiferous ores (H. Kretzschmar) 584,380
Recovering selenium from slimes, sludges and muds (M. L. Hollander and Y. E. Lebedeff, Asarco) . . 584,739
Asarco's continuous tapping method 585,156
Separating nickel from cobalt in mineral acid solution using cobalt or copper sulphide to prevent deposition of the cobalt during electrowinning of the nickel (Societe Gen. Metal. de Hoboken) 585,158
Solvent extraction of uranium (U.S. AEC) 585,174
Ammonium fluorides used with chlorides, sulphates or sulphites to win manganese from high-silica ores (Bruce Williams) 585,206
An intermittent, continuous, pulsing fluidized bed for roasting sulphide ores (Falconbridge Nickel Mines Ltd.) 585,218-9
Sill Process for removing sulphur and arsenic from cobalt-nickel-silver ores by pressure leach and precipitation 585,514
Using excess cobalt to prevent precipitation of copper during the precipitation of cobalt from copper in ammonium carbonate solutions (Mitsubishi Kinzoku Kogyo Kabushiki Kaisha) 585,566

Some Recent British Releases

HCl extraction and distillation of vanadium from slags (U.S. Steel Companies, Ltd.) 816,609
Solvent extraction of uranium with amide (Aktiebolag Atomenergi) 816,628
Concentrating germanium (Asarco) 817,080



NEW! FALK Screw Conveyor Drive

U.S. and Foreign Patents Applied For

—the drive our customers asked for

Our customers helped us design this new unit. We sent our men into the field to find out what our customers needed in a screw conveyor drive—then our engineers designed a new drive that offers the maximum of service, versatility, operating economy and long life. Here are some of its outstanding features:

A COMPLETE DRIVE: Saves engineering and assembly time. Six sizes to cover entire range—each with these ratios: — 4:1, 9:1, 14:1 and 24:1. Bolts to any standard trough end—eliminates trough end bearing. Eliminates drive shaft wobble. Efficient FALK single helical gears.

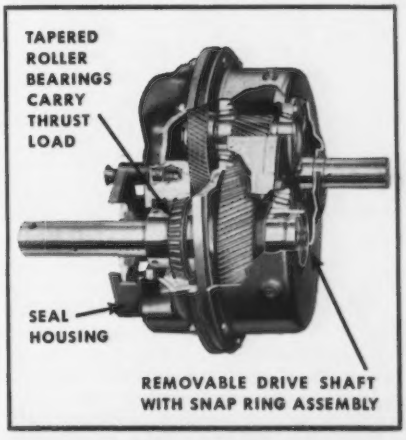
SEAL HOUSINGS: Choice of seals (neoprene or leather lip, felt or waste) to accommodate material conveyed. Space between trough seal and unit seal prevents conveyed material from reaching unit seal.

REMOVABLE DRIVE SHAFT: Snap ring assembly permits easy removal. Five sizes, from 1½" to 3 7/16".

TROUGH END: Can be fastened to any standard trough. Eight sizes, from 6" to 20".

ALL-STEEL MOTOR MOUNT: Saves costly engineering and installation time and costs; no motor plates to design or fabricate. Motor can be mounted in virtually any position. Pre-drilled to accommodate NEMA standard motors ½ to 30 HP.

AN IMPORTANT ECONOMY: Buy only what you need—the basic reducer alone, or with trough end and/or motor mount. For detailed information, contact your Falk Representative or Distributor—or ***write direct for Bulletin 7106.***



THE FALK CORPORATION, MILWAUKEE 1, WISCONSIN

MANUFACTURERS OF QUALITY GEAR DRIVES AND FLEXIBLE SHAFT COUPLINGS

Representatives and Distributors in most principal cities

FALK is a registered trademark

FALK

...a good name in industry

OPERATING IDEAS

Scrap Metal Recovery Method Eliminates Smoke Problem

A SYSTEM THAT DOES AWAY with a good deal of smoke in foundries, scrap metal refineries and similar plants, assuring high efficiency in the recovery of metal turnings, has been installed by Asarco's Federated Metals Div., Los Angeles. The system contains a rotary dryer and after-burner (Standard Steel Co.), Jeffrey crusher, a magnetic separator and various pieces of conveying equipment.

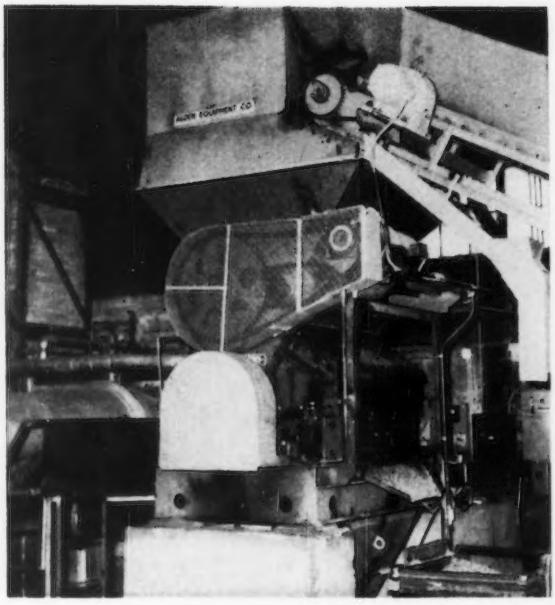
Water and cutting oil are removed from aluminum alloy chips in the turnings process at Federated's plant. If these oil and water-bearing aluminum turnings are charged to the smelter as is, a serious fume problem results. Also, wet turnings can be explosive if pushed beneath the surface of molten aluminum in the smelter.

Asarco handles the problem in the following manner:

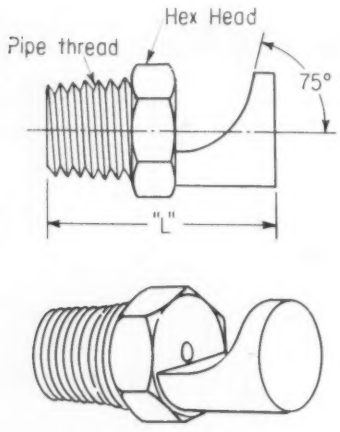
Wet aluminum turnings arriving at the plant are reduced by a Jeffrey crusher—allowing more complete drying and also providing more effective magnetic separation later in the process, with minimum aluminum loss.

Wet feed, at room temperature as it enters the rotary dryer, may contain anywhere from ½ to 40% moisture (water-plus-oil). The turnings themselves, as recovered from the floor and areas around machine shops, do not ordinarily have a high moisture percentage. However, the aluminum alloy turnings are sometimes piled in an open area and rain wets them down.

The standard after-burner is the governing piece of equipment as far as capacity is concerned. Oil on the turnings must be completely burned in the afterburner; otherwise, fumes will result. Therefore, a wet feed containing a high percentage of oil will not be processed by the after-burner as fast as a feed which contains a considerably lower percentage of the oil.



Turnings come out of the dryer at 350°F. Chips from the dryer drop into a bucket elevator and discharge over a magnet. Any iron impurities are thus separated and the dry aluminum alloy chips fall into steel buckets.



How to Pick Nozzle for Varied Pipe Thread

GETTING TO KNOW the proper dimensions of various fog nozzles and making the nozzle in the mine shop is something that can be mastered with only a little practice, according to J. K. Paul, Oak Ridge, Tenn.

"There's no mystery," said Paul, "about the proper dimensions after one has performed some experiments with different shapes, metals and water pressures." The wide-angle type (see drawing) is adaptable for most installations that require fog as a fire-fighting medium with automatic actuating equipment (transformers, spray booths, and quenching tanks).

Almost any non-rusting metal can be made into a fog nozzle. "In fact," Mr. Paul stated, "we have them made of hard rubber, and nylon." Brass is the most popular metal—it's in ample supply at most mine shops and can be easily worked."

The following list gives the nozzle specifications for pipe thread ranging from ⅜ in. to ¾ in.

Thread	Orifice dia	Length "L"
⅜ in.	3/16	1½ in.
½ in.	¼	1¾ in.
½ in.	5/16	1¾ in.
½ in.	⅜	1¾ in.
¾ in.	½	2¼ in.

Automatic Welder Cuts Costs at Bunker Hill Mine Machine Shop

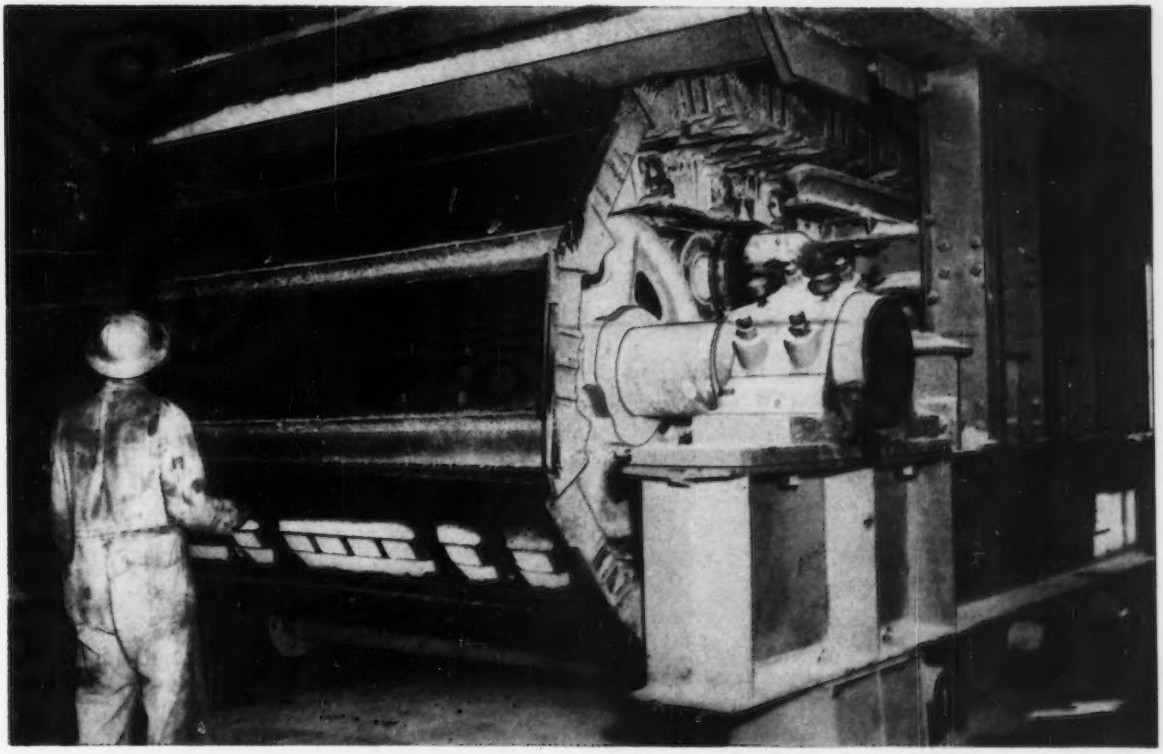
SINCE AN AUTOMATIC welder was installed at the Bunker Hill mine machine shop in 1956, the company, according to the July 1959 issue of its magazine, REPORTER, has been saving money on mine car wheels and locomotive tires.

Before the welder was put in, wheels and tires were thrown on the scrap pile when they wore out. Now, however, the steel tires and wheels are rebuilt by the welding unit for roughly one-half the price of the new items.

Added to this substantial saving is the extended wear of the rebuilt equipment, estimated to be good for one and one half times the life of the new ones.

REPORTER went on to say that the welding machine itself is electrically operated and welds a 5/32-in. continuous welding wire onto the running surface of the welded tire as it is slowly turned. A silica flux is heaped on the weld to speed cooling and prevent oxidation. The average speed of the machine consumes about nine lb of welding wire each hr and four "Big Sam" mining car wheels can be built up in an eight hr shift. ("Big Sam" wheel is 14 in. in dia when new or rebuilt and requires an average of about 12 lb of welding wire). Locomotive tires, up to 29½ in. in dia, may need as much as 100 lb of welding wire to build up. After the one-man welding operation, the wheels or tires are machined smooth and are then ready for remounting.

STEPHENS-ADAMSON



ore handling systems increase tonnage...lower costs

Giant AMSCO Manganese Steel Pan Feeders handle the impact delivered by thousands of tons of run-of-mine ore and stone day after day . . . year after year. The experience of STEPHENS-ADAMSON engineers in the design and construction of Feeders, Apron Conveyors and complete Belt Conveyor systems is a result of 58 years of close contact with bulk handling problems throughout the world. From iron ore in Minnesota to diamond mines in Africa . . . from potash in New Mexico to nitrate and copper in Chile, S-A Engineering "know-how" has produced many of the world's most efficient and profitable conveying systems. S-A engineers with a world of "know-how" and a complete line of manufactured bulk materials handling equipment units are ready to answer your bulk materials handling problem.

A "48" wide primary belt carries a heavy load of 10 inch copper ore to processing at a Southwestern Copper mining installation. STEPHENS-ADAMSON engineered conveyor systems are designed to handle big tonnage dependably and at the lowest operating cost per ton of material handled.

WRITE FOR BULLETIN 255

S-A

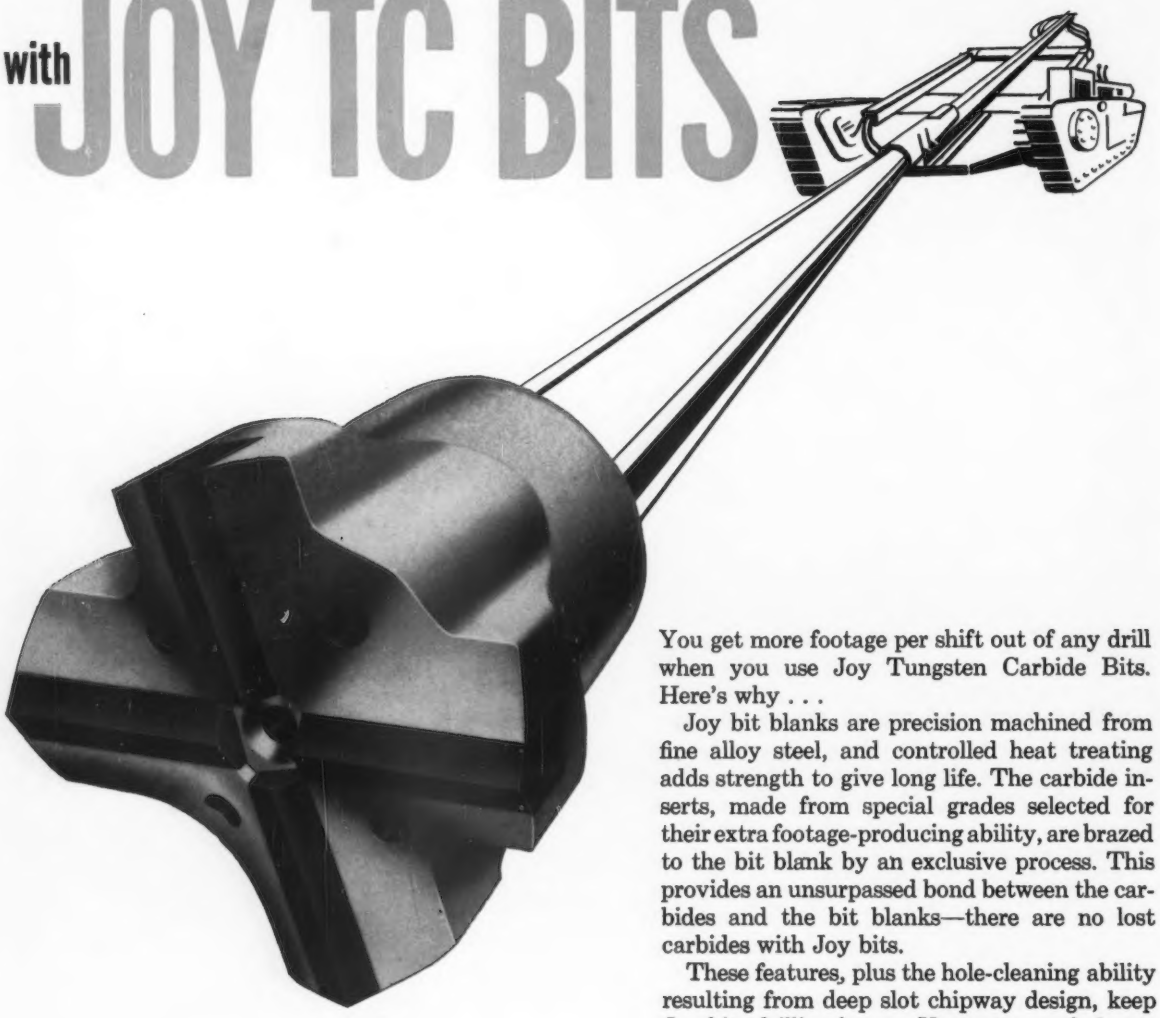
ENGINEERED BULK HANDLING SYSTEMS
MATERIALS HANDLING PRODUCTS
SPEEDVEYOR® PASSENGER CONVEYORS
SEALMASTER® BALL BEARING UNITS
SPHERICO® BEARINGS & ROD ENDS

ENGINEERING DIVISION
STEPHENS-ADAMSON MFG. CO.
GENERAL OFFICE & MAIN PLANT, 4 RIDGEWAY AVENUE, AURORA, ILLINOIS

PLANTS LOCATED IN: LOS ANGELES, CALIFORNIA • CLARKSDALE, MISSISSIPPI
BELLEVILLE, ONTARIO

Get the most out of your drills

with JOY TC BITS



You get more footage per shift out of any drill when you use Joy Tungsten Carbide Bits. Here's why . . .

Joy bit blanks are precision machined from fine alloy steel, and controlled heat treating adds strength to give long life. The carbide inserts, made from special grades selected for their extra footage-producing ability, are brazed to the bit blank by an exclusive process. This provides an unsurpassed bond between the carbides and the bit blanks—there are no lost carbides with Joy bits.

These features, plus the hole-cleaning ability resulting from deep slot chipway design, keep Joy bits drilling longer. You get more hole per bit, and more hole per shift—maximum output from your drills.

For proof of performance, contact your Joy representative. He will be glad to demonstrate Joy Tungsten Carbide Bits. For more information, ask for Bulletin 364-4.

EQUIPMENT FOR MINING . . . FOR ALL INDUSTRY

JOY

Joy Manufacturing Company
Oliver Building, Pittsburgh 22, Pa.

In Canada: Joy Manufacturing Company (Canada) Limited, Galt, Ontario

OPERATING IDEAS *(Continued)*

Quantities Needed to Protect Cooling Systems at Various Temperatures (F°)

Cooling System Capacity Gals/Qts	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	50	60	70	80	90	100
8 - 32	+17	+10	+ 2	- 8	-19	-34	-52																			
9 - 36	+19	+14	+ 7	0	-10	-21	-34	-50																		
10 - 40		+16	+10	+ 4	- 3	-12	-22	-34	-48																	
11 - 44		+18	+13	+ 8	+ 2	- 6	-14	-23	-34	-47																
12 - 48		+19	+15	+10	+ 5	0	- 8	-15	-24	-34	-46															
13 - 52		+21	+17	+13	+ 8	+ 3	- 3	- 9	-16	-25	-34	-45														
14 - 56		+22	+18	+15	+10	+ 6	+ 1	- 5	-11	-18	-25	-34	-44	-54												
15 - 60			+19	+16	+12	+ 8	+ 4	0	- 6	-12	-19	-26	-34	-43	-53											
16 - 64			+20	+17	+14	+10	+ 6	+ 2	- 3	- 8	-13	-19	-26	-34	-43	-52										
17 - 68				+18	+15	+12	+ 9	+ 5	+ 1	- 4	- 9	-14	-20	-27	-34	-42	-50									
18 - 72				+19	+17	+14	+10	+ 7	+ 4	0	- 5	-10	-15	-21	-27	-34	-42	-50	-57							
20 - 80						+16	+13	+10	+ 7	+ 4	+ 1	- 3	- 7	-12	-17	-22	-28	-34	-41	-48						
25 - 100						+20	+18	+16	+14	+12	+10	+ 7	+ 4	+ 1	- 2	- 5	- 9	-12	-16	-20	-34	-62				
30 - 120								+19	+18	+16	+14	+12	+10	+ 8	+ 6	+ 4	+ 2	0	- 3	- 6	-15	-34	-57			
35 - 140								+22	+21	+19	+18	+16	+15	+13	+12	+10	+ 8	+ 6	+ 4	+ 2	- 5	-18	-34	-54		
40 - 160								+23	+22	+21	+20	+19	+17	+16	+15	+13	+12	+10	+ 9	+ 7	+ 2	- 8	-19	-34	-52	
45 - 180									+23	+22	+21	+20	+19	+18	+17	+16	+15	+14	+13	+11	+ 7	0	-10	-21	-34	-50

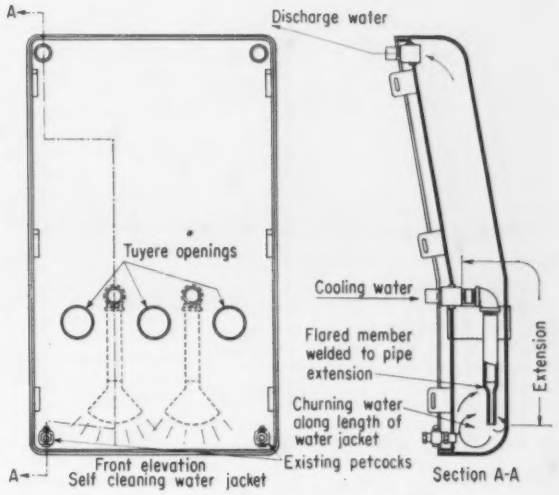
Self Cleaning Bosh Jackets

BLAST FURNACES in lead, copper and steel smelting operations that use river water as a cooling medium through their jackets have a tendency to collect the residue from the water. At the present time, these water jackets are cleaned out by inserting a steel tube supplied with compressed air through a petlock at the lower part of the jacket. This operation has to be done while the furnace is in operation, with the ever-present hazard of getting water into the molten material to cause an explosion —splattering the molten metal.

To overcome this danger, C. H. Suckel, processing machinery department, Allis-Chalmers Mfg. Co., suggests that when new jackets are being made, a pipe extension fitted with a skirted flare be added to the cover.

At this small additional expense, Mr. Suckel said, the jackets become self-cleaning and eliminate the danger of furnace explosions.

However, it is not recommended that the petcocks be done away with—they will still serve as inspection access, but need be used only once every month or two.



Swamp Buggy Floats on Rubber

PONTOON TIRE:—The vehicle at left is a new type marsh buggy, shown coming out of a swampy area on Terra-Tires, made by the Goodyear Tire & Rubber Co. The tires, which are over 5 ft high, 42 in. wide and 18 in. at the hub, are being used on the new Model 400 marsh buggy designed and built by Crain Bros., who selected Terra-Tires because of their low flotation, increased traction and greater mobility. Inflated to the proper pressure, the tires can actually float the 4,000 lb vehicle carrying a 4,000 lb payload. The new marsh buggy will be used primarily for oil exploration and as personnel carriers in swampy areas.

PERSONALS

Gordon A. Mack has been appointed advertising sales manager of E&MJ, E&MJ METAL & MINERAL MARKETS, and COAL AGE. His appointment was effective Jan. 1.

Mack

Mack joined the mining papers' New York business staff in January, 1947, and was later transferred to the mining publications' staff in Chicago. In 1950, Mack shifted to another McGraw-Hill publication, CONSTRUCTION METHODS & EQUIPMENT, and in 1953 he returned to the mining publications.

Charles H. Chase is joining E&MJ advertising sales staff in the Chicago district to replace Mr. Mack.

Chase, who for several years was assistant and general manager of Vulcan Iron Works Co. of Denver, has had wide experience as mining engineer for several western operations and Newmont Mining Co., New York.

Glen D. Chambers of the Yukon Equipment Co. has been elected chairman of the local section of the AIME.

An independent geologist, **Tom Marshall,** was named vice chairman, and **Charles Ledbetter** of the Suntrana Mining Co. is the new secretary.

Newly elected directors of the section are: **R. S. Richards,** independent miner; **Odin Strandberg,** Strandberg Mines, Inc.; and **J. T. Crocker** of the Standard Oil Company of California.

Bernard J. O'Neill, Jr., formerly associated with the New Jersey Zinc Co. as resident geologist in charge of exploration for Pennsylvania and the middle Atlantic states, has accepted a position as geologist in the department of earth sciences of Stanford Research Institute, Menlo Park.

Michael P. W. Stone has been named director of corporate development for Utah Construction & Mining Co.

E. W. Littlefield, executive vice president and general manager, said that the new management post is being created to examine potentially profitable growth opportunities for the company.

William B. York, former chief industrial engineer for the Utah Copper Div., Kennecott Copper Corp., has been named maintenance superintendent at the division's Garfield smelter.

B. Blain Bradford, former chief industrial engineer for KCC's Nevada Mines Div., succeeds Mr. York as division industrial engineer.

Karl H. Koropp, superintendent of operations, Garfield electrolytic refinery, Utah Copper Div., Kennecott Copper Corp., was recently named projects engineer, KCC's western mining divisions, Salt Lake City.

C. Arthur Zeldin, member of project developments group, western mining division's research center, was appointed Koropp's successor.

F. W. Wright, Jr., former general superintendent — mining, has been appointed assistant vice president—engineering, of the Orinoco Mining Co., and will be located at Puerto Ordaz, Venezuela.

Del Carlton, mining engineer with Pickands Mather & Co., has been transferred from Hoyt Lakes to the company's Duluth engineering office.

Bernard W. Zulsdorf, Virginia, has been appointed safety engineer for Oliver Iron Mining Div.'s eastern district, according to John Chisholm, eastern district general superintendent.

A new firm of consulting engineers, Dorr Consultants, has been formed to provide engineering, financial, and management services to the chemical process, textile, and metallurgical industries.

The five founding partners are: **John Van Nostrand Dorr, Arthur K. Doolittle, Donald F. Othmer, W. George Parks,** and **William E. Randolph.**

Dr. Dorr is a chemist and metallurgist, inventor of Dorr metallurgical and sewage treatment equipment and founder of the Dorr Co. He is also honorary chairman of Dorr-Oliver, Inc.

Arthur K. Doolittle is a chemical engineer and is author or co-author of many patents and is an authority on solvent-resin technology, protective coatings and adhesives. He is president of the Arcadia Institute for Scientific Research Inc. Donald F. Othmer is head, department of chemical engineering, Polytechnic Institute of Brooklyn, and is the author of some 75 patents.

W. George Parks is head, department of chemistry, University of Rhode Island; director, The Gordon Research Conferences; executive director, National Academy of Sciences-National Research Council Advisory Board on Quartermaster Research and Development and a member of the scientific advisory panel to the Secretary of the Army.

William E. Randolph is a civil engineer with extensive experience in mining, metallurgy and is a specialist in the development of water supply systems.

The following are recent staff promotions at U.S. Borax Research Corp., subsidiary of U.S. Borax & Chemical Corp.:

Dr. Edgar Fajans, formerly associate director of chemical research, will be special assistant to the vice president;

Drs. Howard Steinberg and **A. L. McCloskey** have been named as associate directors of chemical research. Dr. Steinberg has been serving as assistant director of chemical research. Dr. McCloskey held the post of senior group leader in chemical research.

Walter A. Steiner has been appointed vice president (technology) of National Carbon Co., division of Union Carbide Corp. Mr. Steiner, who has been vice president in charge of development since 1954, will now be responsible for both the research as well as the development activities of the company.

M. L. Bailleau, formerly managing director of Broken Hill Associated Smelters Pty. Ltd., Melbourne, has been named the firm's board chairman.

At the same time, **J. B. Shackell,** formerly assistant managing director, was made managing director and **Frank Green,** manager of the company's works at Port Pirie, became a member of the board of directors.

Raymond E. Salvati, Huntington, W. Va., president of Island Creek Coal Co., president of the American Mining Congress, has been named to receive AIME's Erskine Ramsay Gold Medal at the Institute's national convention, New York, Feb. 14-18, 1960. The citation reads:

"For his outstanding contributions and achievements in the development and application of modern technology in underground coal mining and in the preparation of bituminous coal, and for his many years of distinguished leadership within the industry."

Earl C. Van Horn, consulting geologist of Murphy, N.C., was elected president of the Carolinas subsection of the AIME at a meeting at Kings Mountain, N.C., Nov. 6. He succeeds **S. J. Beers,** chief engineer, Industrial Mining, Inc., York, S.C.

W. T. McDaniels, chief engineer of the North Carolina State College minerals laboratory, Ashville, was named vice chairman, and **L. J. Hash,** geologist for the Zonolite Corp., was elected secretary, succeeding **W. A. Horst,** resident engineer of the Foote Minerals Co. of Kings Mountain, N.C.

T. B. Leech has been named vice president and director of export sales for Yuba Consolidated Industries, according to **John L. McGara,** president. Leech will coordinate the export sales program for all Yuba divisions from the New York Sales office.

OBITUARIES

John D. Bradley, president and director of The Bunker Hill Co., and his wife Jane, were both killed Nov. 27 near San Francisco when the car in which they were riding was struck by an oncoming car. A son, John E., was also in the accident, but was not critically injured.

Bradley

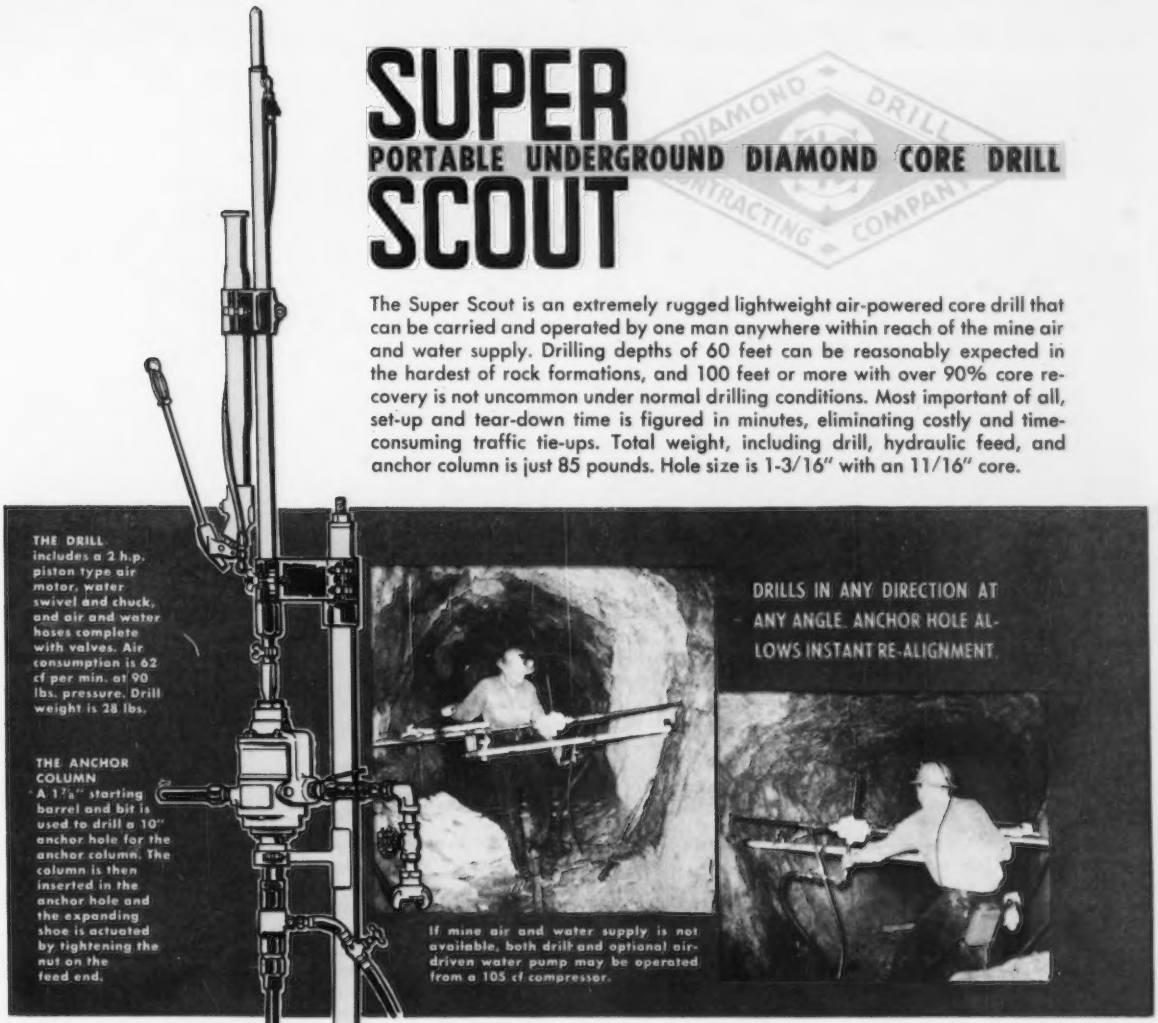
Mr. Bradley was born in San Francisco on Oct. 26, 1910. After he graduated from the University of California School of Mines in 1933 with a BS degree in mining engineering, he became an underground surveyor in the Bunker Hill mine. He later became superintendent of the Spanish Mines near Nevada City, Calif.—a job which called for management of a complex gold ore operation. Mr. Bradley then went on to become executive vice president and director of the Bradley

(Continued on p 156)

SUPER SCOUT

PORTABLE UNDERGROUND DIAMOND CORE DRILL

The Super Scout is an extremely rugged lightweight air-powered core drill that can be carried and operated by one man anywhere within reach of the mine air and water supply. Drilling depths of 60 feet can be reasonably expected in the hardest of rock formations, and 100 feet or more with over 90% core recovery is not uncommon under normal drilling conditions. Most important of all, set-up and tear-down time is figured in minutes, eliminating costly and time-consuming traffic tie-ups. Total weight, including drill, hydraulic feed, and anchor column is just 85 pounds. Hole size is 1-3/16" with an 11/16" core.



THE DRILL includes a 2 h.p. piston type air motor, water swivel and chuck, and air and water hoses complete with valves. Air consumption is 62 cf per min. at 90 lbs. pressure. Drill weight is 28 lbs.

THE ANCHOR COLUMN A 1⅞" starting barrel and bit is used to drill a 10" anchor hole for the anchor column. The column is then inserted in the anchor hole and the expanding shoe is actuated by tightening the nut on the feed end.

If mine air and water supply is not available, both drill and optional air-driven water pump may be operated from a 105 cf compressor.

DRILLS IN ANY DIRECTION AT ANY ANGLE. ANCHOR HOLE ALLOWS INSTANT RE-ALIGNMENT.

THE HYDRAULIC FEED

The hand-operated pump actuates the piston-type fed leg. Length of feed stroke is 2½ feet. 10 pounds pressure on the pump handle delivers 1000 lbs. at the bit. In up or down holes within 30 degrees of vertical where the back wall is within reach, the drill and hydraulic feed assembly may be used without the anchor column.

THE SUPER SCOUT Drill, hydraulic feed, anchor column, water and air hoses and valves, line oiler, wrenches, and two transportation and storage boxes.

f.o.b. Spokane $1,095

Drilling requirements are so varied that rods, bits, and other accessories are not included in the basic kits. However, a complete line is available for any drilling need in both standard and oversize equipment.

DIAMOND DRILL CONTRACTING CO.

South 18 Stone Street Spokane, Washington, U.S.A.

Eastern and Southwestern Distributor
SPRAGUE & HENWOOD, Inc.
Scranton 2, Pa. — Grand Junction, Colo.

Export Representatives
SPRAGUE & HENWOOD International
11 W. 42nd St., New York, N. Y., U.S.A.

SPEAKERS included Norman L. Krey (left), northwest operations manager for Kaiser, and Bruce W. Gonser of Battelle.

THE TRADITIONAL, and fruitful, coffee hour talks took place. George Deshler (left) Asarco, and Sam Moyer, Cyanamid.

NWMA

(*Continued from p 23*)

the project are now underway. Steel erection will start in January and major equipment units will be delivered in March. He described the 100-ton pig iron furnace project as the first step toward an integrated steel operation. Facilities are being planned to provide for expansion of up to 1000 tpd of iron. The sintering machine at the project will have a capacity of 500 tpd iron while the first furnace will have a capacity of 100 tpd. Thus the first furnace, he said, will operate on a 24 hour basis while the sintering plant will only operate part time as required to provide the furnace feed. This, Stanley said, permits a ready increase in furnace feed as planned furnace expansion proceeds.

Another speaker at the "New Developments" session was George J. Fegan, manager of quality control for Pacific Northwest Alloys, Inc. at Mead, Wash., ferroalloy producer.

"In the last 20 years," said Fegan "the use of alloy steels has been spreading so, that now nearly every consumer of formed or cast steel products specifies some alloys or properties which can only be obtained by using alloys."

"Many small mills and foundries that once considered themselves strictly a mild steel producer are now regularly turning out low alloy steel heats. If full advantage is taken of the various ferroalloys and exothermic alloys now available, all will benefit from the superior properties of properly made alloys of iron and steel."

H. Dewayne Kreager, director of the Washington State Department of Commerce and Economic Development, outlined the economic implications of recent mineral developments in the state and he urged mining interests to unite to protect their interests in the state. He suggested the formation of a state mining commitee.

Another speaker at the "New Developments" session was Donald L. Olson, associate electrical engineer for Washington Water Power Co. in Spokane, who described the private utility participation in the atomic energy program.

Co-chairmen of the session were E. W. Greenfield, director of the division of industrial research at Washington State university, Hollis M. Dole, director of the Department of Geology and Mineral Industries at Portland, Ore.

James Quigley, vice president of Centennial Development company, Eureka, Utah, was the lead-off speaker at a "Mine-Operating" session Dec. 5. Describing the use of circular shafts in western mining, he said the chief benefits of circular design are:

1. Greater strength because the walls are in compression.
2. Heavy water inflows can be more easily controlled by both pre-grouting and by grouting during sinking.
3. Less resistance to air flows.
4. Low maintenance costs.
5. Suitability for modern mucking and drilling machinery.

Such advantages, he said, are considered well known, but the question of the application of circular design to western mining boils down to the adaptability of small diameter designs to western problems and the possible added cost of circular construction.

However, he said that present natural and economic pressures will require western operators and engineers to study circular methods and costs thoroughly before undertaking any new development project.

"It is equally clear that these studies will result in more and more circular shafts being sunk in western mining camps."

Quigley said that time and natural conditions will inevitably bring circular design into more and more future projects even in areas where timbered shafts have served adequately for many years.

Innovations at the Grandview mine near Metaline Falls, Wash., were described by John W. Currie, resident manager for American Zinc, Lead and Smelting Co.

He said the firm has made three major new changes in mechanization of mining at the property during the last 15 months. One was a "Transloader" used in mucking work and transporting ore. It was developed from the "Gismo" self-loading transport designed by Dale Hayes, former western manager of the firm. It was put in service in the fall of 1958 and combines the Gismo unit with a two-wheeled rubber-tired tractor unit.

Currie said that in the first year of operation, the unit handled some 144,000 tons of ore, hauling distances up to 1850 ft and up grades as high as 20%. The unit hit a maximum performance of 960 tons in one shift. A second unit went into service this fall.

Another new development is the use of percussion drills for long hole exploration work which Currie said was being done at about one-eighth the cost of diamond drilling.

The design, construction and performance of the Star-Hecla crosscut plug at Hecla Mining Co.'s operations at Burke, Idaho, were described by Robert B. Davis, mining engineer with Hecla. He termed it completely effective as a water seal and said it has resulted in substantial savings in pumping costs and shaft maintenance.

Other speakers at the mine operating session included Clifton W. Livingston, president of Barodynamics, Inc., Georgetown, Colo., "The Application of Explosions Research to Blasting in Mines and Quarries", and John R. McWilliams, mining research engineer with the U.S. Bureau of Mines at Spokane, "Rock Pressure in Deep Mines."

An "Exploration" session Dec. 5 was told that the Spokane office of the Bureau of Mines is using a mobile spectroscopic laboratory to aid exploration work.

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PD

DEAN E. F. COOK of the University of Idaho talks with Karl Fair, of Northwest Prospecting and Development Co.

STEPHEN SCHILT, of Dow Chemical Co. was among the registrants at the two-day mining conference.

MORE COFFEE and talk was enjoyed by George A. Williams (left) of U. of Idaho, H. F. Albee, USGS.

NWMA

(*Continued from p 106*)

Eldon C. Pattee, mine examination and exploration engineer at the Spokane office, said the unit is being used for work in Idaho and Montana.

The work of the Washington State University Geo-Hydrologic Research Group was described by E. Roy Tinney and James W. Crosby of the WSU division of industrial research. Tinney heads the school's Albrook hydraulic laboratory and Crosby is assistant mining geologist. Current projects of the group include an experimental investigation for the city of Moscow, Idaho, to map the structure of the Moscow basin by seismic means and thereby establish the ancient drainage basin; an experimental attempt to map water tables in glaciofluviatile formations using seismic methods; and a statistical analysis of precipitation in an area over a period of years.

Other speakers at the session included Sherwin F. Kelly, president of Sherwin F. Kelly Geophysical Services, Inc., Vancouver, B. C., "Can the Impending Drain on Mineral Resources Be Met?"; and William Harrison White, professor of economic geology, University of British Columbia, "Cordilleran Tectonics in British Columbia."

Development and operations of American Zinc, Lead and Smelting Co.'s mines in Tennessee were described in a paper prepared by Howard I. Young, president of the firm, and presented by William Black, manager of the company's Tennessee operations. It was presented at a session on "Mining and Government," and cited the benefits of geological work in developing the firm's mining properties in Tennessee.

American Zinc, he said, has four active mines in the Mascot-Jefferson City district. These include the No. 2 mine at Mascot, now producing up to 2,000 tpd; the North Friends Station mine with 375 tpd output; the Young mine with 2,500 tpd and the Coy mine, now running at 500 tpd.

Tax deductions for mining depletion were defended by Dean E. F. Cook of the University of Idaho school of mines. He indicated that such allowances were designed to enable a mining firm to recover the capital value of a minerals deposit as it is being depleted through production.

He termed the depletion allowances a powerful incentive to the development and production of minerals deposits. Pointing out that the industry requires new capital far in excess of present depletion deductions, he said that the depletion allowances should be increased.

Other speakers at the session included Thomas R. Walenta, University of Idaho professor of law, "Recent Legislation and its Effect on Recovery"; and W. W. Kiernan, British Columbia minister of mines, "Mining Outlook in British Columbia."

R. R. McNaughton, manager of the metallurgical division of Consolidated Mining and Smelting company of Canada, Ltd., was the speaker at a Dec. 5 luncheon sponsored by the Columbia section of the AIME. He outlined the history and growth of Cominco operations.

A paper presented by Arthur H. Sorenson, research geologist for Hecla Mining company at Wallace, Idaho, outlined the origin of the Coeur d'Alene mining district ore deposits and their possible relations to some large scale structural features. He noted that much progress has been made in recent years in large scale structural interpretation of the geology of the Northwest. He said this progress has partly resulted from the increasing use of geochemistry and the techniques of isotopic analysis of ores and rocks. Sorenson was the lead-off speaker at the Dec. 5 "Geology" session.

Progress in development of the uranium deposits of the Stanley area in Custer county, Idaho, was outlined by Raoul Choate, minerals engineer for the Idaho Bureau of Mines and Geology. It was the convention's only paper on uranium, apparently indicating a dwindling interest in uranium by the Northwest mining industry. (Recent conventions of the NWMA have featured several papers on uranium developments in the Mount Spokane and Spokane Indian reservation mining districts.)

At any rate, Choate was optimistic about the Stanley area, where he said development of uranium deposits is in a preliminary stage. Total production, he said, slightly exceeds 5,000 tons of .17% ore. He added that evidence indicates that a large body of ore may exist at Stanley, but he said that future economic development of the deposits would depend on such factors as the discovery of a major orebody, development of a cheap but efficient system for upgrading ore and continuation of Government purchase programs.

Other speakers at the "Geology" session included C. L. Sainsbury, geologist with the USGS, "Metallization and Hypogene Post-Mineral Alteration, Lost River Tin Mine, Alaska"; George F. Warning, geologist at Cominco's HB mine at Salmo, B. C., "Geology of the HB Mine"; and J. C. MacLean, property superintendent, "The HB Mine."

A "**Metallurgy**" **session** included papers by: Fred C. Bond, consulting engineer in the process machinery department of Allis-Chalmers Manufacturing Co., "Action in a Rod Mill"; Rolf Edholm, manager of production planning, General Electric Co., Milwaukee, "X-Ray Emission as an Analytical Tool in the Laboratory and on the Process Line"; A. H. Robertson, research director with the USBM office at Albany, Ore., Advances in High Temperature Metals Technology"; and W. A. Boyer, manager of industrial engineering, Bunker Hill Co., "Application of Industrial Engineering to Metallurgical Operations."

The group reelected E. K. Barnes, retired Spokane banker and mining execu-

Special report to owners of Traxcavators, D6 and D4 Tractors

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Now available...lifetime lubricated rollers...two-way savings...

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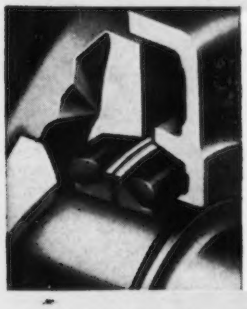
Here's another cost-cutting improvement for Traxcavators and both D6 and D4 Tractors . . . lifetime lubricated rollers. Now you can eliminate on-the-job shutdowns for greasing. And you get longer life from rims, flanges, internal parts. The payoff . . . reduced replacement costs, savings in time.

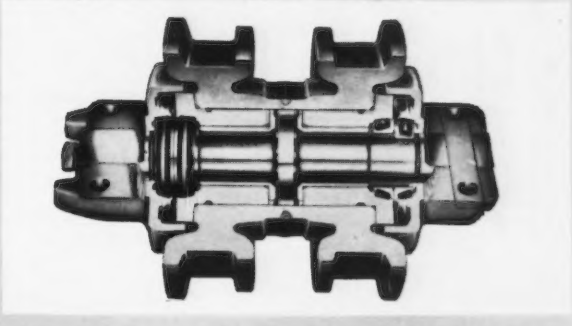
How maintenance is eliminated—the new Cat-built rollers are lubricated when first installed. They are equipped with floating ring seals that keep lubricant in . . . grit out . . . for the life of the rollers. Only when rollers are disassembled for rebuilding will relubrication be necessary. And the original metal rings can be reused.

New floating ring seal . . . only four parts, no springs. The roller seal employs two alloy metal rings and two rubber "O" rings. The metal rings, much harder than the best file steel, have lapped faces, smoother than glass. These faces taper slightly toward the inner edge forming a sealing area at the outer edge. As wear occurs, the sealing area moves gradually inward, maintaining a perfect seal for thousands of hours.



The "O" rings keep constant pressure on the metal rings. Lubricant can't get out. Grit can't get in. There are no springs or diaphragms to weaken, wear or become damaged. The "O" rings are made of special compound to resist oil, heat, cold.

Why do roller parts last longer? Grit is permanently sealed out. Big lubricant reservoirs (with strategically located oil passages) insure ample supply of lubricant to moving parts. Oil instead of grease is used for roller lubricant. Oil dissipates heat faster, circulates more freely than grease. These features assure you of longer shaft and bearing life. Longer bushings with extra-thick flange assures rigid support. Large sleeve bearings provide ample bearing area. Larger diameter, deep-hardened shafts withstand higher shock loads. Beam strength has been increased 63% for D6 shafts; 185% for D4 shafts. Resistance to side thrust is greatly increased in D4 shafts by a 25% wider center flange and 73% more thrust-bearing area.



Why do rims and flanges last longer? The new two-piece roller shell has greater strength and impact resistance. Special heat-treat process provides extra-hard and deep wear surfaces. Ample steel under tread gives strong support to resist shock loads. Thicker flanges combat peening over. Overlapping center joint maintains rigid shell without separate hub.

Easy installation is achieved by use of snap rings to hold the seals and end collars in place before mounting. End collar bolt holes will line up easily with track roller frame holes during installation.

Millions of hours of proof—the toughest track rollers yet. Cat lifetime lubricated rollers have been subjected to extensive and exhaustive on-the-job tests for over 5 years. Working on all types of job conditions, these time-tested rollers have proved to be unequaled. And machine-owner reports prove that Cat lifetime lubricated rollers can't be beaten for low-cost, minimum maintenance operation.

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SERVICE TIP: When rebuild time finally comes, be sure to keep the metal rings matched in original pairs, being careful not to nick or mar the lapped surfaces.

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NWMA (*Continued*)

tive, to a third term as president. Ross D. Leisk, consulting mining engineer in Spokane and a former executive of the Sunshine Mining Co., was reelected to one of the two vice president posts. A new officer of the association is Malcolm C. Brown, president of Sidney Mining Co., Kellogg, Idaho, who was named to the other vice presidency. Frank Marr, Spokane, was renamed treasurer, and Robert J. Towne was elected secretary. The association also named five new trustees: P. E. Oscarson, Spokane consulting mining engineer; Robert B. Austin, manager of the Coeur d'Alene Hardware and Foundry Co., Wallace, Idaho; A. R. Patterson, vice president and general manager of Knob Hill Mines, Inc., Republic, Wash.; E. H. Lovitt, and Charles E. Schwab.

Resolutions adopted by the convention showed a mounting concern for the plight of the domestic lead-zinc industry and the need for more labor reform legislation.

The group asked that import taxes be used instead of quotas to control imports of minerals. It urged that quotas be used only when no other adequate protection is practical or available. The association also opposed any action that would relax present restrictions on the disposal of Federal stockpiles of minerals or metals unless positive safeguards are preserved to insure that the disposal will not disturb normal prices and marketing conditions.

The labor reform resolution was somewhat stronger than those passed previously by the group. It asked: elimination of exemptions of unions from anti-trust laws, prohibition of compulsory unionism, removal of union immunity from injunctions in Federal court, freedom from Federal compulsion in collective bargaining procedure, effective prohibiting of mass picketing, effective prohibition of use of union funds for political activity, a ban on industry-wide bargaining and on industry-wide strikes, a ban on union practices and combinations which operate to fix prices and restrain competition, prohibition of strikes unless approved by supervised ballot vote of all employees in the bargaining unit concerned.

Other resolutions asked Congress to monetize Treasury Department stocks of "free silver" and to amend existing legislation to eliminate the 30% seigniorage that is charged domestic producers of silver. It also asked that the Treasury Department cease sales of silver at less than the monetary value of $1.29 an oz.

Another resolution recommended that the price of gold be increased to encourage an increase in domestic production and that the withdrawal of gold reserves be checked to preserve the integrity of the U. S. dollar. Congress was asked in the resolution to fix the ratio at which the dollar and gold are fully convertible and to abolish present restrictions on the ownership and sale of gold and silver by U. S. citizens.

A tax resolution asked that exploration expenditures be made fully deductible from income taxes, exemption of new mining properties from income taxes for three years after commercial production is started, repeal of the excise tax on transactions in silver bullion, a reduction in income and corporation taxes and boosting the tax allowance on dividends.

The attendance figure topped 900, one of the best in recent years for the convention. All sessions were held at the Davenport hotel.

Huge Molybdenite Deposit Claimed in Sardinia

A MILLION-DOLLAR PLANT for open pit mining an estimated 5-million tons of molybdenum ore will go into operation in central Sardinia by the end of 1960, according to the engineering firm of Mazzacurati & Giacomelli, of Rome, which made the discovery of the seven square kilometer deposit in November 1957 while building a 60-mile highway from Nuoro to Monti.

Funds for the plant will either be raised privately or will come from the Italian Government, said Construction Engineer Arturo Giacomelli who estimated the worth of the ore, molybdenite, MoS_2, at approximately $800-million.

He said that 60 samples from the deposit had been tested by geologists from the autonomous Sardinian government and by professors from the University of Cagliari. These showed the ore grade as averaging between 0.5% and 0.6% molybdenum. A sum of $160,000 was spent on this research.

Mazzacurati & Giacomelli have leased the deposit area from the Sardinian government and plan to operate the plant themselves when funds have been fully raised.

Bluewater Cuts to 6 Days In Contract Stretch-Out

A SIX DAY A WEEK OPERATION and reduction of ore run from 3,500 tpd to 3,000 tpd was agreed to by Anaconda Co., in extension of uranium concentrates purchase contract with Atomic Energy Commission.

Grand Junction Operations office of AEC said of the new multi-million dollar negotiation which permits Anaconda to sell through to Dec. 31, 1966:

"Approximately 4-million lb (valued at about 32 million dollars) will be deferred to the 1962-1966 term under the new contract."

In the "stretch-out" Anaconda will run its Bluewater, N.M. mill six days a week and not seven days as provided for in earlier contract expiring March 31, 1962.

The firm recently dropped production from its 750-tpd alkaline leach circuit and in the new contracting will run only its acid circuit.

The new contract is retroactive to May 1, 1959.

Of course, only ore developed prior to Nov. 28, 1958, can be run through mill and sold as concentrates to AEC.

Now—more light, less weight, longer life with

NEW EDISON MODEL S ELECTRIC CAP LAMP

MSA announces another new *high* in lighting efficiency in the world's most popular cap lamp. Increased light output of the new Edison Model S Lamp assures greater safety for the miner, more tons per shift for the operator. Let's face a fact: Dimness costs money. *Fair* lighting does only a *fair* job. Maximum lighting—the brilliant, unfailing Edison Model S kind—helps get jobs done with top speed and safety. And the simplified method of charging new Model S Batteries—with the AUTOMATIC LOW-VOLTAGE SYSTEM—is convenient, thrifty and highly efficient. Lets miners take their lamps and rack them—quickly—without loss of time or waste motion. When planning a new lamphouse installation or modernizing your present one, call in the MSA Representative. MSA can help you solve your lighting problems.

Newly issued U.S. Bureau of Mines Approval 6D-31, April 16, 1959.

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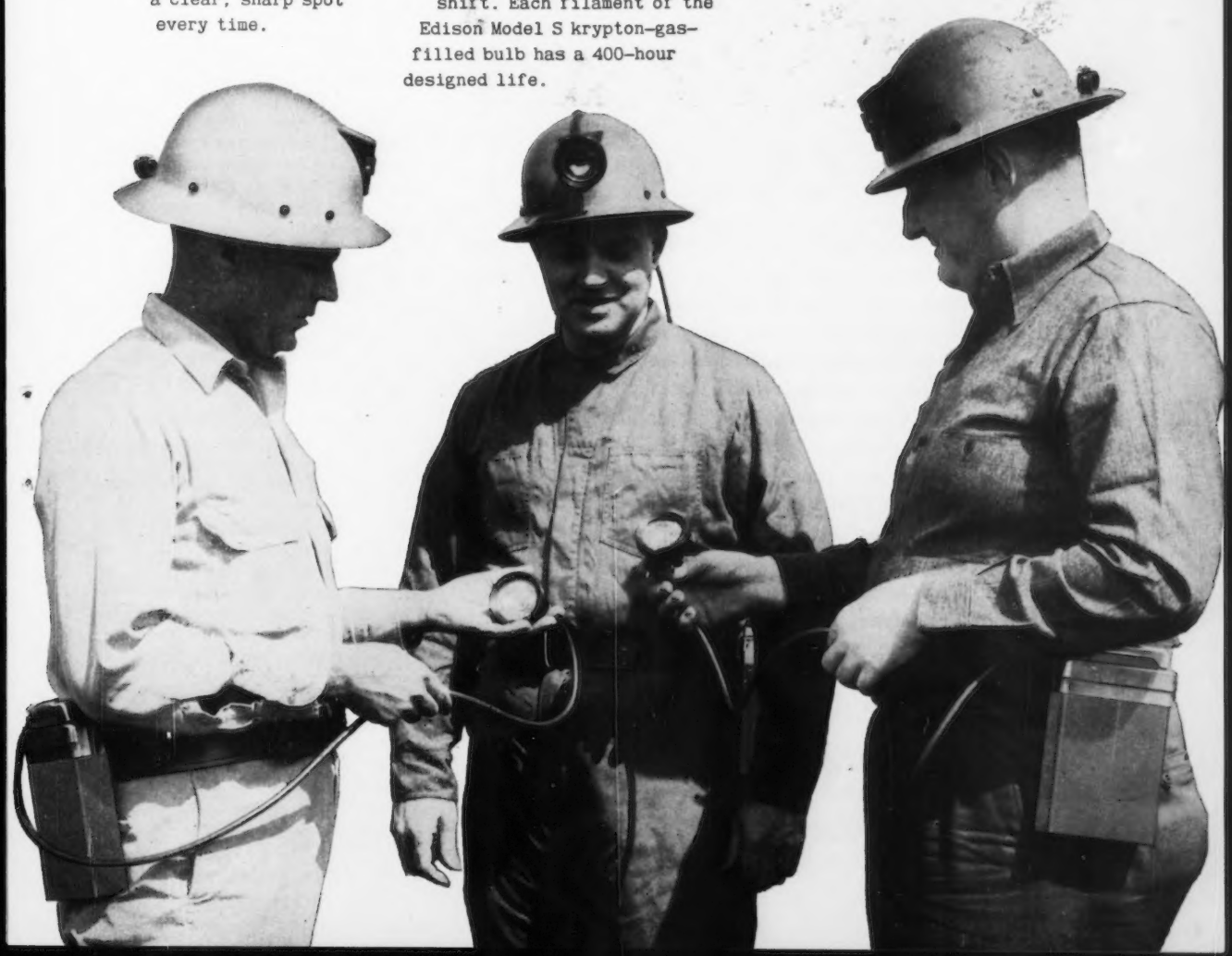
Look how small the headpiece is. Weighs only a few ounces. Feels even lighter on the head. You get a clear, sharp spot every time.

Increase in working light appeals to me. This new Edison Model S gives 15% more than we ever had before. And they didn't cut their bulb service life rating to do it. The double filament bulb means we'll always have working light to finish the shift. Each filament of the Edison Model S krypton-gas-filled bulb has a 400-hour designed life.

Just watch the improvement in our safety and tonnage reports. More light. Less weight. Longer life. Even the battery's better. It has a new active material that boosts service life. They went all-out to meet the miner's needs with this one.



They Blend and Reclaim From A Million Ton Stockpile

with a 10-Yard Cableway DragScraper

At this 400-ft. by 1,000-ft. storage area, ore is reclaimed from an 80-ft. stockpile to two 3,000-ltph. longitudinal conveyor slots. Ore directly over the slots is reclaimed by gravity—all remaining material is handled by a 10-yd. Cableway DragScraper.

Before the Sauerman Machine was installed, ore was moved to the slots by a small fleet of crawler units operating on the ore pile. Steep slopes and great heights made their operation hazardous.

To eliminate this and reduce labor costs, the crawlers were replaced by the Sauerman Cableway DragScraper. Now, no men are needed on the storage pile, and ore may be reclaimed from any point in the area at will. The latter feature is particularly helpful in blending the ore and insures uniform quality.

The Cableway DragScraper consists of two self-propelled towers paralleling the storage. A 10-yd. DragScraper Bucket and carriage ride the track cable suspended between them. Electrically driven drum hoists located in the towers control hauling, hoisting and conveying. Despite its size, the Sauerman unit can be operated by one man.

DragScraper Machines are built in sizes from ⅓ to 15 yds. to handle stockpiled bulk material in both outdoor and indoor storage facilities. Write or call about your requirements. We'll recommend the proper machine for you and forward appropriate literature.

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Manganese Plant Planned For Colorado Plateau Area

A $6,704,000 MANGANESE REFINERY will be built at either Durango or Grand Junction, in Colorado, or at Castle Gate, Utah, according to Russell Wood, assistant general manager, Standard Uranium Corp., Moab, Utah.

Wood said that Standard would not build the plant which would utilize rhodonite (manganese silicate) from Standard's Sunnyside mine at Silverton, Colo.

Instead, an unnamed "eastern group" has concluded agreements with Standard for supply of the rhodonite concentrates which would be reduced by one of two electrical-chemical processes now under study, Wood said.

Rhodonite is the gangue, or host material in which much of the lead-silver-gold-copper values at Silverton are found.

The new manganese refinery wouldn't be placed under construction until spring of 1961, said Wood.

Nchanga (*Continued from p89*)

resistance in the transfer zone. Each idler is a small roller about 6 in. wide, fastened together by pieces of roller chain so the idler hangs in a catenary curve. Advantages in the American and German designs noted by Mr. Kolbe are:

1. The idler rocks with the blows. That was one of the serious problems encountered in the operation of the stacker, and development of the idlers completely solved the problem of boulders and frozen material bouncing and rolling back on the stacker belt.

2. Weight is only a fraction of that of the conventional type.

3. Cost is less.

4. Two men can change an idler in a minimum of time, whereas changing a conventional unit is a major job.

5. The belt tracks much better.

6. Shape of the catenary curve can be adjusted by nuts to make a smooth belt path.

7. Supporting structure is simple.

8. Space under the idler is open, and there is no dirt buildup.

9. Contact between belt and idler is much improved.

The 60-in. stacker belt on the present Cuba wheel is 5 ply with 7/16-in. top cover, including five nylon cord breakers (one longitudinal and four bias) and a 3/32-in. bottom cover, including one longitudinal breaker.

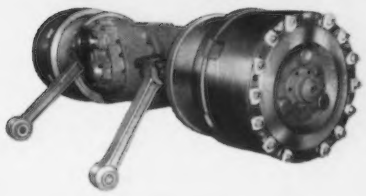
One advantage noted by Mr. Kolbe for high belt speeds, other than fast conveying of material to the dump, is that a rapidly running belt heats more quickly. Heating is due to internal friction at flexure points and external friction on the idlers and pulleys and results in more efficient operation during cold weather.

"Easiest handling 35-ton truck in the business!"

Why? 35 tons on a single rear axle truck is really something! That's a big load. But it means greater maneuverability—shorter cycling—easier spotting—savings of time which means greater tonnage production.

Consider too, the added advantage of minimized service requirements of the single axle over the tandem.

Want more facts on this model? Write for specifications.



The D-100-S triple reduction is a tried and proven, planetary-drive axle, backed by years of customer acceptance. Completely designed and built by KW-DART, it has unusually high capacity and long, trouble-free service life.

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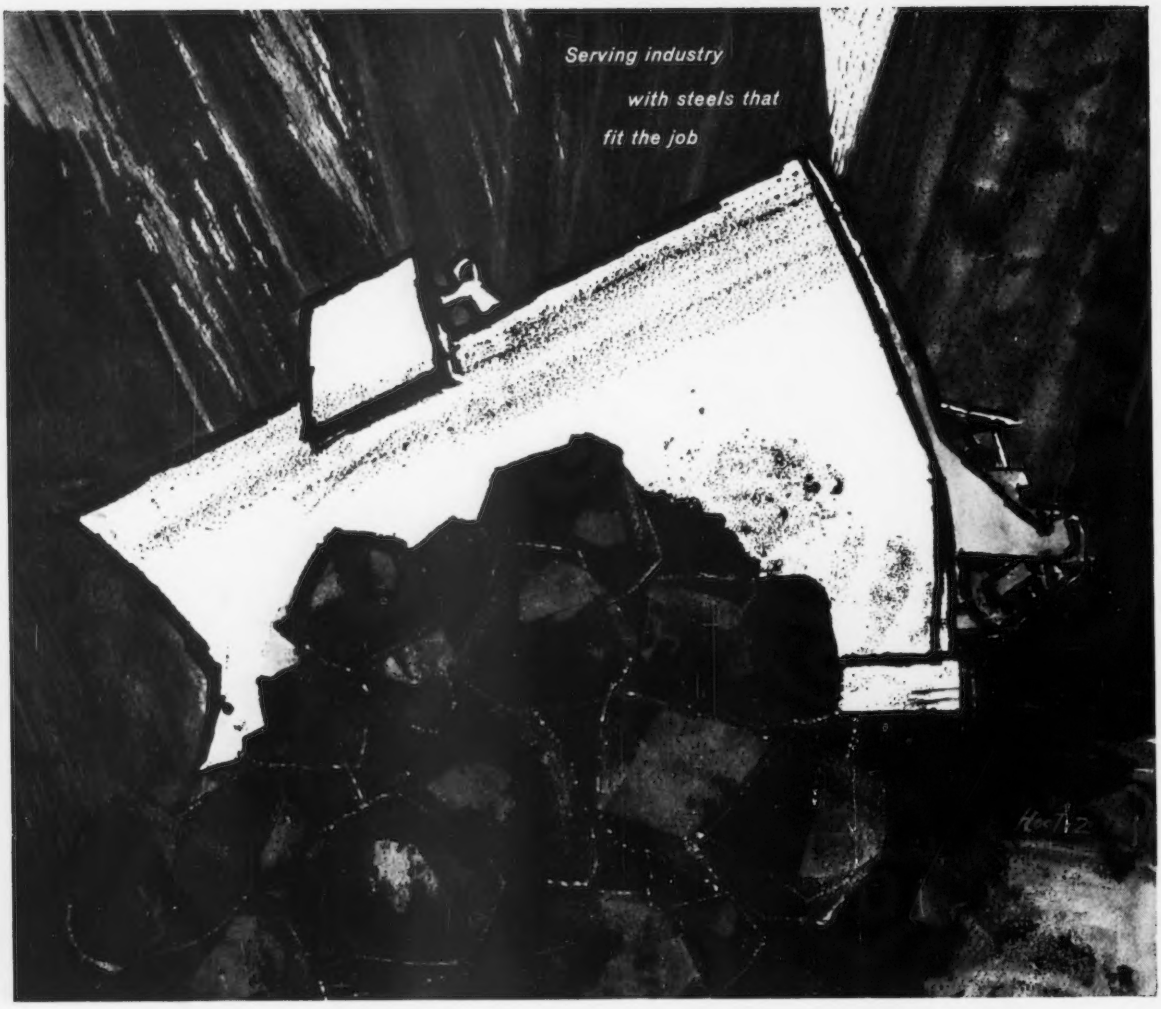

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You can order Lukens "T-1" steel plate from these Steel Service Centers:

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ALASKA

Reports in Anchorage indicate a rich molybdenum strike has been made in the Hayes Glacier area 80 miles northwest.

The deposits are reported to have been discovered by Dick Clement of Anchorage.

The assay report also indicated there are substantial quantities of gold, lead, iron and sulphur in the area.

Clement made his strike Sept. 21 and withheld announcement of the find until an assay report had been made.

In partnership in the venture with Clement are C. E. Knowles of Buffalo, N.Y., and John Baker of Anchorage.

The area containing the ore encompasses about three square miles. It has been named the Clement Lode and comprises 56 claims including 1,120 acres.

CALIFORNIA

Jefferson Lake Sulphur Co. of New Orleans has exercised its option to acquire from American Asbestos Co., New York, a major deposit of chrysotile asbestos near Stockton. Jefferson's exploration work has proved about 15-million tons of commercial ore. Plans are for immediate installation of mining equipment and a 2,000 tpd mill. (E&MJ, December p.128).

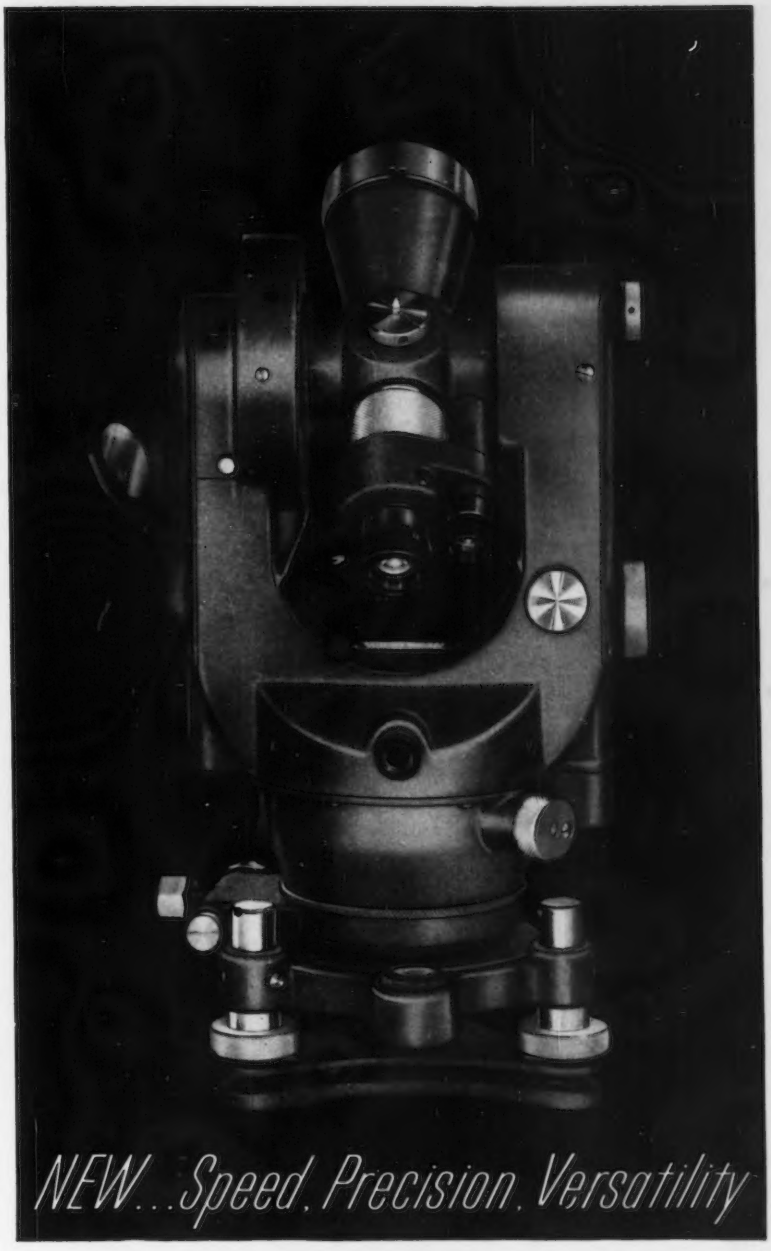
John L. McGara, president of Yuba Consolidated Industries, Inc., and Frank J. Maloit, president of White Canyon Mining Co., announced that agreement has been reached, subject to White Canyon shareholders' approval, covering the sale of all of the assets of White Canyon to Yuba.

White Canyon has been engaged for a number of years in the mining of uranium and owns 370 claims. In addition, the company has oil and gas leases on a total of 28,397 acres. All of the claims and leases are located in San Juan County, Utah, an area active in uranium, oil and gas production.

COLORADO

The Western states produced about 1.7-million oz of gold during 1958. Almost one-third of this gold came from South Dakota where Homestake Mining Co. operates the famous gold mine. An appreciable portion came from the famous Cripple Creek District of Colorado. Other major primary production was from placer operations in Alaska and California.

About one-third of the gold production came as a by-product of copper or from complex western ores. If the price of gold were increased, as has been suggested, it would, of course, greatly stimulate exploration.



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Colorado *(Continued)*

Standard Uranium Corp., W. H. McCormick, president, has announced excellent progress in extending the drift in the Sunnyside nonferrous metal properties in the Silverton district. This development work preliminary to mining of a known orebody should be completed by the year's end, McCormick said. The concentrator at the firm's lead-zinc properties in Colorado's Crested Butte area has been put through shakedown operations and will be placed in service as soon as current strikes in the nonferrous metals industry are ended.

W. F. Monson, head of Denver Golden Corp.'s project near Silverton reports progress on the tunnel at Clear Lake. The operation, while in high country, will continue as long as roads can be kept open. Thirteen men are employed at the Little Dora south of town. Drifting has started on the lower level and two shifts are employed. When stoping gets under way and ore stockpiles are adequate, milling of the ore at the Pride Mill will begin.

O. A. Sutton is ceasing, temporarily, his operations of the Carter Mine property on Gold Creek, about five miles above Ohio City, according to information given by Andrew J. Lang, resident manager and geologist for the mining operations. This puts a crew of about 24 men idle for the next six months, Lang said. "We are not giving up, but a strike at the Leadville Smelter makes it impossible for us to market our ore."

Jack Dick has hauled down from Animas Forks, eight tons of sorted ore which is part of a 30-ton lot he hoped to have hauled to the new Becker Smelter in Durango before snow flies. The ore is from the Columbus and assays well in silver, gold, lead and copper content. The new process smelter in Durango expects to treat the ore as soon as it gets into operation, which should be very shortly. It is reported that trial runs by the smelter were highly satisfactory. The new plant is located east of Durango.

A new gold-silver discovery in the Crested Butte mining district has been reported as a substantial development of Gold Crest Mining & Milling Co. It has invested some $150,000 over the past two months in development of the property and plans to strip-mine a substantial vein of gold and silver ores. Metallurgical ore testing has been undertaken by the Colorado School of Mines Research Foundation.

Gold Crest officials made plans for the erection of a straight flotation mill at the site. The mill will have a 100-tpd capacity when production work is resumed at the mine next spring.

IDAHO

Three North Idaho district mining companies, Callahan Consolidated Mines, Inc., Bismarck Mining Co. and Nabob Silver-Lead Co., have filed suit in Fed-

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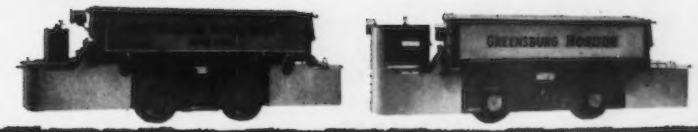

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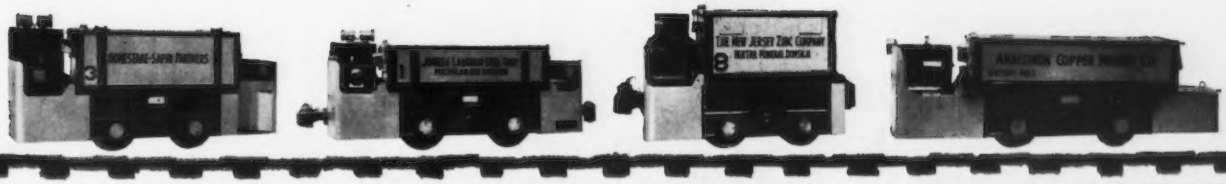

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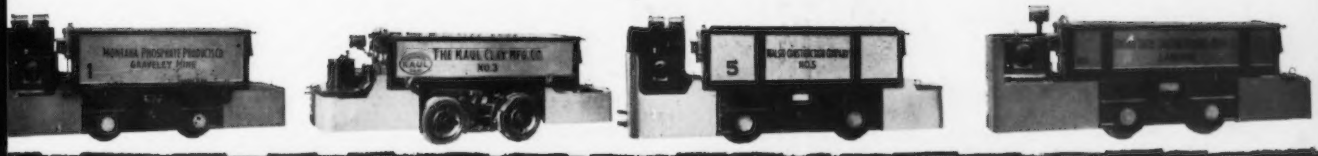

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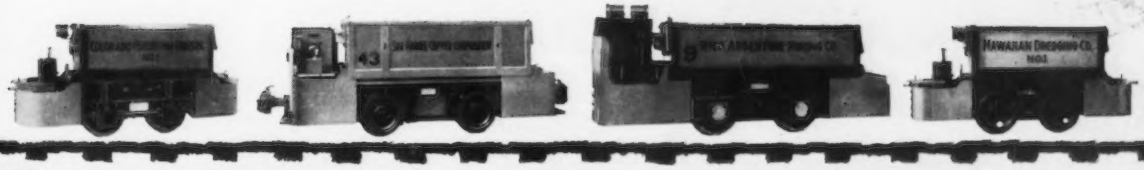

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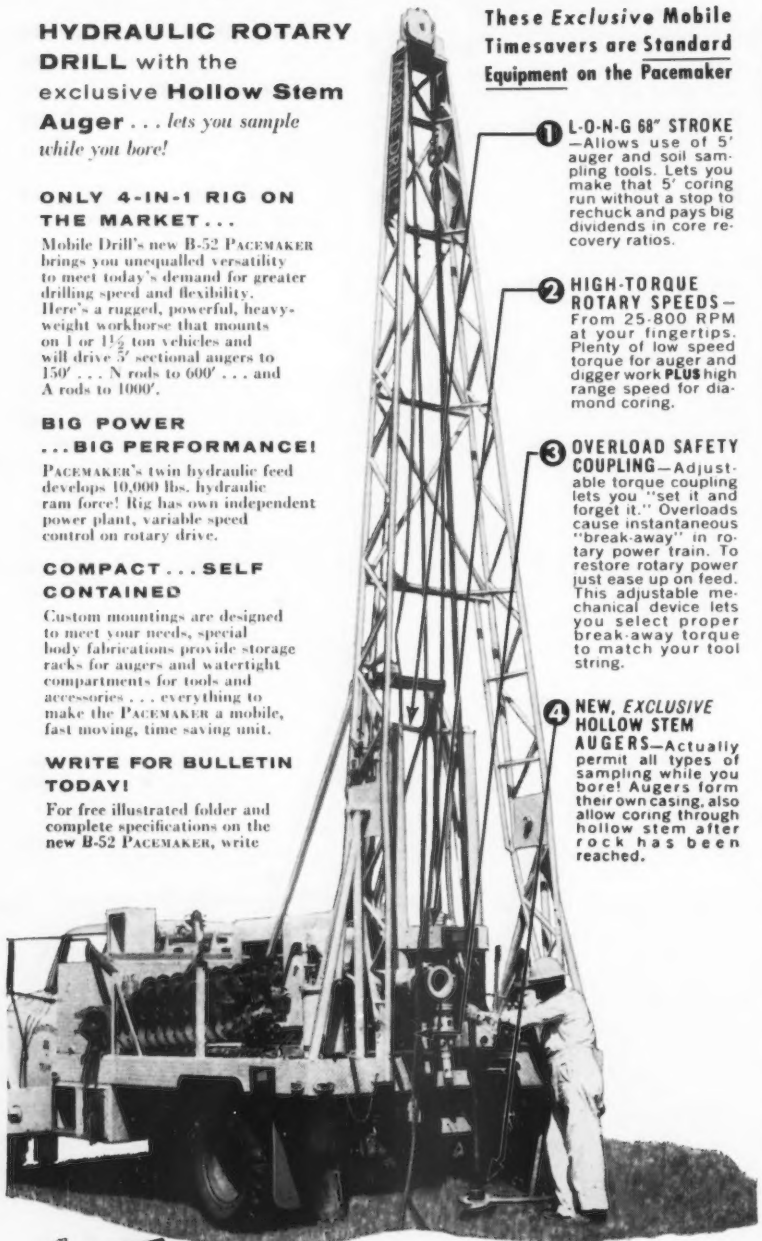

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Idaho (*Continued*)

eral court at Coeur d'Alene asking that the Securities and Exchange Commission and its western regional administrator, James E. Newton, Seattle, be enjoined from enforcing or attempting to enforce sections of the act affecting the levying of assessments on these and other mining companies. Such assessments are provided for in the Idaho state constitution and mining code and provide the means for the companies as well as others to finance exploration and development, the complainants say.

Agency Creek Thorium and Rare Metals Corp. of Salmon have signed an agreement with Rare Metals Corporation of America for development of the Lemhi Pass thorium properties in central Idaho. Rare Metals has announced it will do metallurgical work this winter and start development work in the spring.

Hecla Mining Co. has announced abandonment of its exploration at the Silver Mountain property east of Mullan, after four years of work and an expenditure that approximates $1.5-million. L. J. Randall, company president, said all work has been discontinued and workmen have pulled rails and removed mining machinery. Original objectives of the project were reached and results were negative, he said. Bunker Hill participated with Hecla in the program.

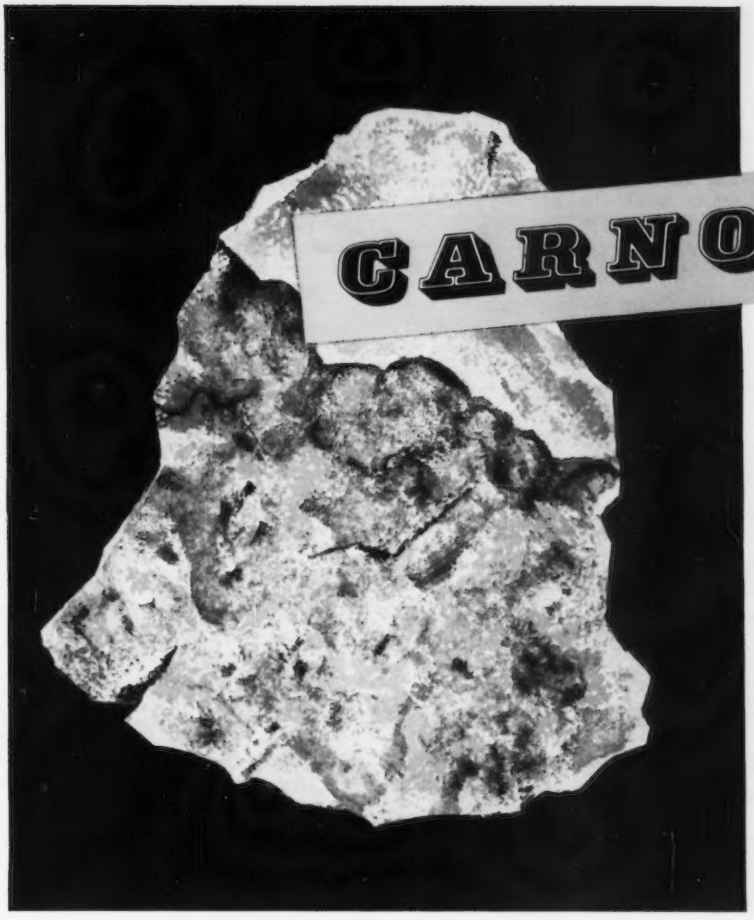
The Center Star mine at Golden, near Grangeville, in Central Idaho, is employing 10 men after reopening this fall and is preparing to ship concentrates. Harold Lynch, veteran Central Idaho mining man, is in charge of the work.

Northwest Prospecting and Development Co. has completed a 13-hole drilling program begun in October on its thorium properties on Hall Mountain north of Bonners Ferry in the northernmost tip of Idaho. Carl Greear, secretary-treasurer of the company, said the work has proved an extensive ore zone at the property.

The Galena mine near Wallace, owned by Callahan Mining Co. and operated by American Smelting & Refining Co. and Day Mines, Inc., is the scene of a new silver vein discovery that carries assays reaching as high as 200 oz silver to the ton. Asarco has a 75% operating interest and Day Mines a 25% interest in the property.

With cold weather and heavy snow seriously interfering with operations, all surface exploratory work has been stopped at the Jack Waite mine of Asarco north of Wallace and underground exploration work has been limited to driving a 300-level drift, J. C. Kieffer, northwestern mining department of Asarco, stated at Wallace.

A. Y. Bethune, manager of metallurgy for Bunker Hill Co. at Kellogg, reports his company is supplying the electronics industry with super-pure antimony metal for the manufacture of transistors. He said the electronics industry has turned to Bunker Hill as a source of supply. Bunker's main operations are at Kellogg,



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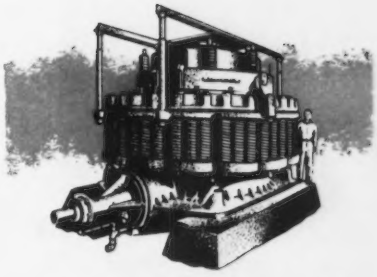

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Idaho (*Continued*)

where it has announced plans for capacity operation of its electrolytic zinc plant through reactivation of a fifth processing unit that has been idle since November 1958. This will boost the plant's annual capacity to 74,000 tons.

Sunshine Mining Co., with holdings west of Wallace, has announced plans for development at depth in the east end of the mine. A crosscut is being cut on the mine's 4,000-level to a selected site from which a shaft will be cut to a point below the 4,300 level and upward to the 3,700 level, the mine's main haulageway. The purpose of the work, company officials said, is to prospect recent discoveries shown at depth by diamond drilling from the 3,700 level.

Heavy damage but no loss of life was reported Nov. 29 in the wake of a dam break which sent a 5-ft wall of water crashing down the narrow gulch in which Burke nestles.

The earth-filled Glidden dam, three miles up the canyon burst Nov. 28 under the weight of the runoff from unseasonable rains and snow melt.

Mud, silt and rocks were deposited over much of the town. Roads leading to the dam were cut, a Montana Power Co. line was washed out, and a 60-ft section of the highway leading to Wallace, 10 miles away, was washed out.

Shoshone County sheriff's officers said the 400 residents of Burke and power company workers living up the canyon apparently came through the disaster unscathed.

Water from the small storage dam also ripped out more than 100 ft of flume supplying water to mine and mill operations of the big Hecla Mining Co. in Burke.

Low-grade material left from Calera Mining Co.'s cobalt mining operations at the Blackbird mine in Lemhi County is being milled to produce copper concentrate, officials of the firm said.

Production of cobalt concentrate was halted June 5 when a contract with GSA was completed and not renewed.

Since June, the company has been milling low grade material left from its open pit operation. Only copper concentrates, containing small amounts of gold and silver, are being produced.

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ILLINOIS

Wiley Cochran, owner and operator of Tamora Fluorspar Mining Co. in Hardin County, describes his recent Lee property lease, five miles northeast of Karber's Ridge, as "the best-looking vein of spar," both as to width and grade, that he had ever found. Sinking to 170-ft has been completed. The vertical vein runs 12 to 15 ft in width.

MICHIGAN

A cold snap, which froze iron ore, halted all shipments from mines Dec. 4. The ore shipping season in Michigan's Upper Peninsula ended Dec. 12, rail, mine and ship officials reported.

Pickands Mather & Co. mailed a letter to all its employes Nov. 8 signed by E. L. Joppa, Duluth, general manager, offering them a wage advance which the company estimated as a 15¢ per hour increase. It provided no raise during the first year and reserved the right to decide on local working conditions. Increases would be given during the second and third years and certain pension and insurance changes made. Arbitration of what changes should be made in the new contract as to working conditions was included.

After 200,000 tons of ore had been loaded, ore shipping was practically halted on Saturday, Nov. 14, when cold weather froze over 1600 car loads on the way to the Escanaba docks. Steaming facilities could not keep up with shipments. After this experience cars were allotted to each mine, loaded promptly and forwarded to the docks as rapidly as possible to hold freezing to a minimum.

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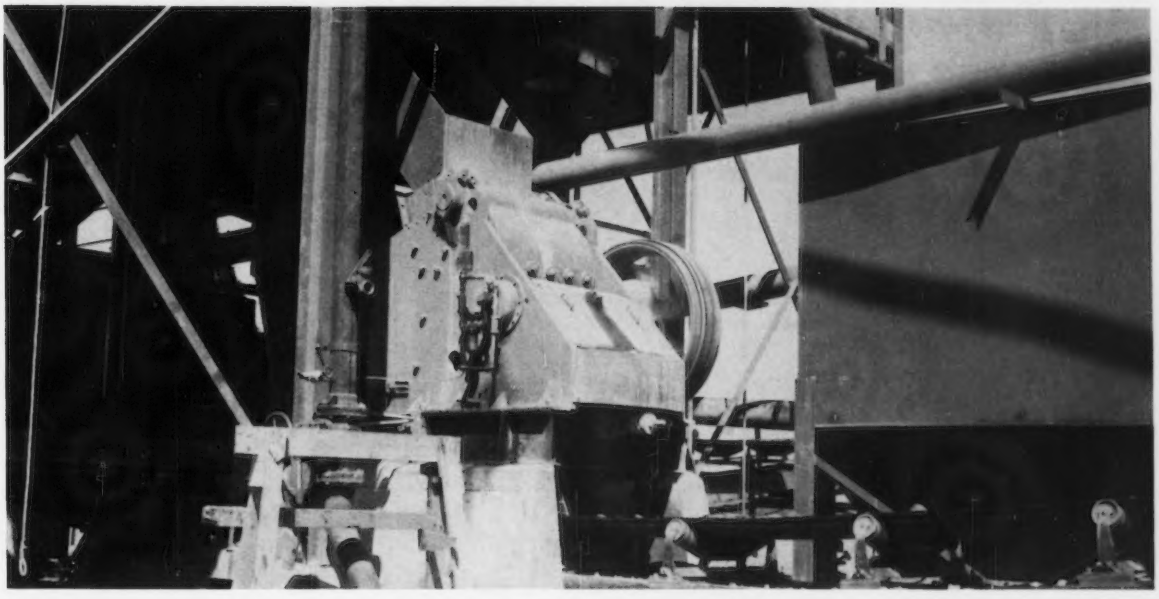

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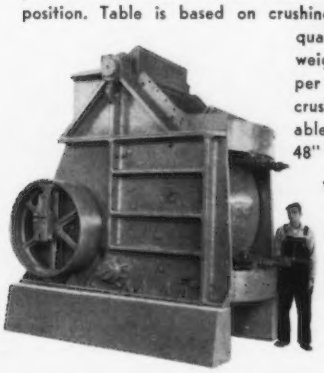
30" x 12"	32	35	38	42	55	70	76	85	110			20 to 30
36" x 10"	38	47	57	67	80	91	105					25 to 40
36" x 20"					70	82	90	115	135	160		30 to 50
42" x 25"					90	120	150	165	180	215	250	40 to 60



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Michigan *(Continued)*

worked two shifts on Thanksgiving day to load incoming boats. It was the only mine in the area to operate that day.

Humboldt Mining Co. will install two parallel lines of Allis-Chalmers "grate-kiln" pelletizing systems at its low grade iron ore concentrating operation near Ishpeming. The units are scheduled to start production by mid-1960.

The installations will be the heart of Humboldt's expanded mining and concentrating operations in the Michigan peninsula. The two units will boost the firm's hematite iron ore concentrating to 2,000 tpd.

Although the "grate—kiln" method has been used successfully in the commercial production of cement, the Humboldt installation will be the first time it has been applied on a full scale basis in low grade iron ore processing. The systems have, however, been tested for some time at a pilot plant at Carrollville, Wis.

Equipment to be furnished will include four large balling drums 9 ft in diameter by 30 ft long, vibrating screens, chain type grates on which pellets travel while being heated, two rotary kilns 10 ft in diameter and 120 ft long, two annular coolers 25 ft in diameter for pellet cooling, and electrical equipment.

MINNESOTA

The Lake Superior Mines Safety Council held its November meeting at Grand Rapids. John C. Richards, special representative of the Hercules Powder Co., discussed the safe use of explosives; Nino Fiorio, district safety officer of the Minnesota Highway Dept., talked on "Death on the Highway"; T. A. Findlay, safety director, Minnesota Electric Cooperative, gave a demonstration of low voltage electricity; R. N. McIndoo, assistant supt. of maintenance for Oliver Iron Mining Division's western district, spoke on "Material Handling" and Louis J. Zaveri, Duluth, presented a paper on the broad subject of "Mine Safety."

Since the Minnesota legislature, in 1959, passed laws providing certain tax advantages for the mining of "semi-taconite," there has been some discussion as to just what material the term covers. Stephen E. Erickson, director of beneficiation for the M. A. Hanna Co., in his paper "Trends in Iron Ore Beneficiation," given in September 1959 at the American Mining Congress in Denver, defines it.

Quoting from his paper: "Broadly speaking, semi-taconite is anything between hard, solid taconite and the material that can be economically treated in the present washing and heavy media plants."

Ore shipped in the last three weeks of November, with every company doing its utmost to load every car possible, amounted to 5,065,952 tons. This compares to 4,281,562 tons for the full month in 1958, and in spite of unfavor-

Unshot Rocky Digging

This Marion 151-M works a 35-40 foot bank of unshot, rocky digging on the Iron Range. Its ability to produce low unit costs under difficult digging conditions has made the 151-M a familiar sight in open pit mines across the nation. Why not let a Marion mining specialist project 151-M unit costs on your property? For years, Marion has been recognized for recommending the right methods and the right machines to produce needed tonnage at the lowest possible costs.

CONSULT MARION MINING SPECIALISTS
for lowest costs on your property!

MARION POWER SHOVEL COMPANY • Marion, Ohio, U.S.A.

A Division of Universal Marion Corporation

Harbison-Walker monolith-

Economical methods for durable constructions

Casting H-W Extra Strength Castable, as in this flue arch, is an easy and time-saving method.

Gunning H-W castables has certain application advantages which save maintenance time and furnace availability.

THESE LONG-ESTABLISHED LEADERS CONTINUE

Harbison-Walker has more than two-score different castable refractories, plastic fire brick and ramming mixes of conventional classes and various modifications especially adapted for new specific uses. In composition they span all the usual refractory oxides, stabilized natural and synthetic minerals, from the most definitely acid to the most strongly basic. These chemical properties, together with the physical characteristics in the combinations best suited for severe operating conditions in metallurgical furnaces, provide the refractories for best economy.

In accordance with the best practice for the particular purpose, Harbison-Walker monolith-forming refractories are installed by various methods —such as pouring or tamping, troweling or gun-placement—depending upon the product and its application. For many purposes, they are used for complete linings free of joints, for maintenance in making both small and very large patches. Special shapes for emergency or prompt needs can be fabricated for immediate use.

Several applications of special interest are here briefly described:

The use of **H-W EXTRA STRENGTH CASTABLE** is highly successful in multiple hearth roasters, fluidized solids reactors and subbottoms of invert arches in various refining furnaces.

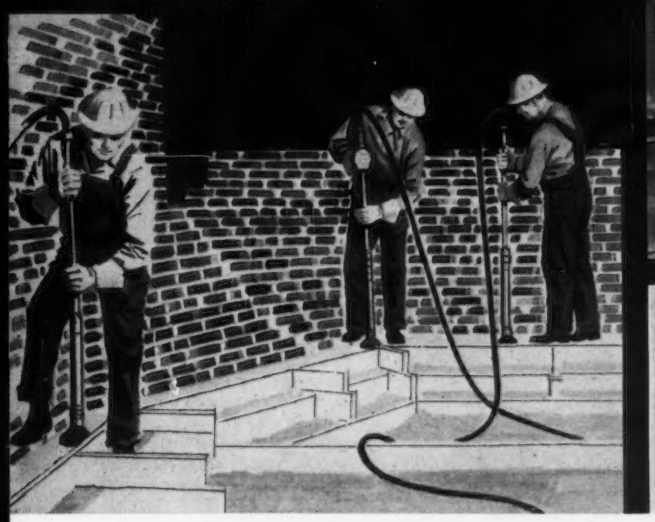
CHROMEPAK, the highly basic castable having great resistance to erosion, is proving its good serviceability in charge-hole positions of reverberatory copper smelting furnaces. In a specific modification, it holds particular promise of serving for tuyere patching and for center sections of electric furnace roofs which otherwise involve costly cutting and fitting of brick shapes.

forming refractories

. . . *for metallurgical furnaces*

Ramming H-W Super Plastic-CS lining in a side wall, prior to setting first row of refractory anchors.

Contour-ramming furnace bottoms with H-W C-Mix reduces furnace downtime and saves labor.



MAKING MANY EXCELLENT SERVICE RECORDS

CORALITE (22-58) RAMMING MIX, in the class of 85% alumina refractories, is a development particularly for use in contact with molten aluminum and its many alloys. When rammed into place and heated to a temperature approaching the melting point of aluminum, it becomes exceedingly strong and resistant to mechanical abuse which frequently accompanies the charging of cold metal into the furnace. This specialized ramming mix is particularly adapted for use in lower side wall construction because of its resistance to penetration and corrosion by molten aluminum alloys. As used in side walls, the usual dross formation does not readily adhere and accumulate as accretions which interfere with furnace operation.

H-W C-MIX is a high purity stabilized periclase product which now is used principally for contour-rammed open hearth and electric furnace bottoms. Its use greatly reduces furnace downtime, saves labor and avoids burning-in sacrifice of refractory superstructure.

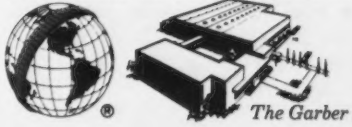
The many types and classes of these Harbison-Walker refractories include lightweight insulating products, special gunning mixes for maintenance and others of compositions and properties best suited for use in contact with molten aluminum in the many alloy compositions, lead and zinc as well as various other nonferrous metals.

Please write for complete detailed information for the various uses of special interest.

HARBISON-WALKER REFRACTORIES COMPANY

AND SUBSIDIARIES **GENERAL OFFICES: PITTSBURGH 22, PA.**

World's Most Complete Refractories Service



Leadership in Refractories Through Constant Research

The Garber Research Center

CUSTOM TREATED FILTER CLOTH FOR LONGER LIFE

Every NFM FILTER CLOTH gets a treatment specifically designed to withstand the conditions it will meet on the job. Our cottons are specially impregnated to resist *acids* and *alkalies*. We treat our glass fabrics with silicones and Teflon for *abrasion* resistance. Our cottons and synthetics get the full treatment for *stability:* cold water shrinkage, hot water shrinkage, and heat setting. Nylon gets a dose of neoprene and Hypalon; glass fibres take vinyl shots for their health.

The longer the life — the lower the cost

Service life is the true measure of filter cloth economy. By selecting from the many NFM FABRICS the one that is *custom treated* to last longer in *your* filtration process, you save most where the costs are highest: by reducing down-time, change-over labor, and replacement. When the problem is tough, call the doctor for the NFM ECONOMY TREATMENT.

(Reg TM DuPont)

Tell us your application, we will send you samples

Weavers of Industrial Filter Media for over Fifty Years

NFM NATIONAL FILTER MEDIA *Corporation*

General Offices and Mills: New Haven 14, Conn.
Western Office and Factory: Salt Lake City 10, Utah
Sales Offices—Representatives

Alhambra, Calif., 20 South First Street
Chicago, Ill.: 6034 N Cicero Ave.
Elizabethton, Tenn.: Paul Chapman Assoc., Box 787
Cincinnati, Ohio: Roselawn Center Bldg.
Houston, Texas: 1607 Jefferson Avenue
Pensacola, Fla.: Chem-Quip Co., 1102 Texar Drive

Minnesota (*Continued*)

able weather conditions much of the time. Total shipments from the Great Lakes, including Canadian ports were 43,541,344 tons as of Nov. 30 vs 52,792,715 tons for the first 11 months of 1958.

Another move by Oliver Iron Mining Div., U.S. Steel Corp. to upgrade the declining quality of Mesabi ore has been made with start of construction of the new 1.5-million tpy (output) Sherman concentrator. The unit, scheduled for operation in the 1961 ore season, will contain a washer, scrubber, heavy media and a spiral plant, and will operate in conjunction with the Sherman sizing plant.

MONTANA

Anaconda Co. has purchased the Butte Copper & Zinc Co., a manganese producer in Butte, it was announced Nov. 27.

The price was not given but Anaconda officials did confirm the purchase of the Butte Copper & Zinc Co. holdings, including the Emma mine and other mining claims. Spokesman for the company said that it was not contemplated that the properties involved in the purchase will be operated.

It was explained that the primary purpose of the purchase was to consolidate the company's holdings in the Butte area. On Sept. 29, Butte Copper & Zinc Co. and Jonathan Logan, Inc., a leading producer of women's apparel, announced consideration of a merger. It was indicated at that time that the new company proposed to take over Butte Copper & Zinc's listing on the New York Stock exchange.

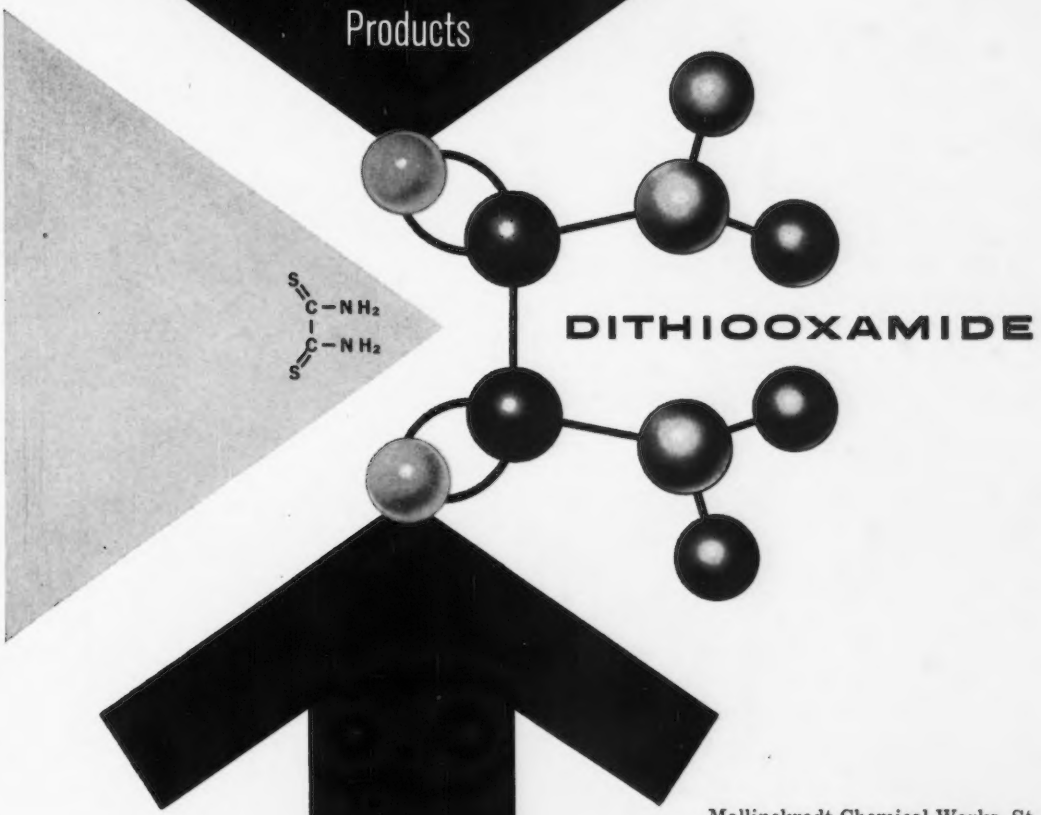
The Emma mine, operated by the Anaconda Co., was closed down at the start of the August strike and has been flooded. It was reported in September that the likelihood of its reopening was remote.

At the time of the announcement of the proposed merger with the women's apparel organization, it was said that the move was regarded merely as a stock listing proposition, giving Jonathan Logan & Co., a listing on the New York Stock Exchange.

NEVADA

U.S. Milling & Minerals Corp. shipped 30 bars of gold-silver bullion weighing a total of 37,648 oz during November. The shipment was made from the company's mill at Silver Peak in Esmeralda County. Ore handled at the mill comes from the firm's Mohawk and Nivloc mines near Silver Peak and from its Ohio mine 30 miles southeast of the mill at Gold Point. Custom ore is also handled from Tonopah, Goldfield, Bishop and Virginia City. Samuel L. Levine is president of U.S. Milling & Minerals Corp. and James O. Wike is office manager.

SULPHUR
helps
to create
Headline
Products



DITHIOOXAMIDE

Mallinckrodt Chemical Works, St. Louis, Missouri, recently announced this new building block...a chemical that can go in many directions to create new and better products. For example, the manufacturer suggests applications for dithiooxamide and its derivatives in the fields of metal sequestrants, pigments, organic intermediates and plant growth regulators.

A new building block with many potentials ...and as with so many such chemicals, Sulphur is a key ingredient!

Our business is to produce Sulphur ...to keep adequate supplies on hand at our production units...to deliver it in solid form by rail, barge or ship; in molten form in trucks, tank cars, barges, or ships. All of the properties listed below can supply both solid and molten Sulphur.

TEXAS GULF SULPHUR COMPANY

75 East 45th St., New York 17, N. Y.
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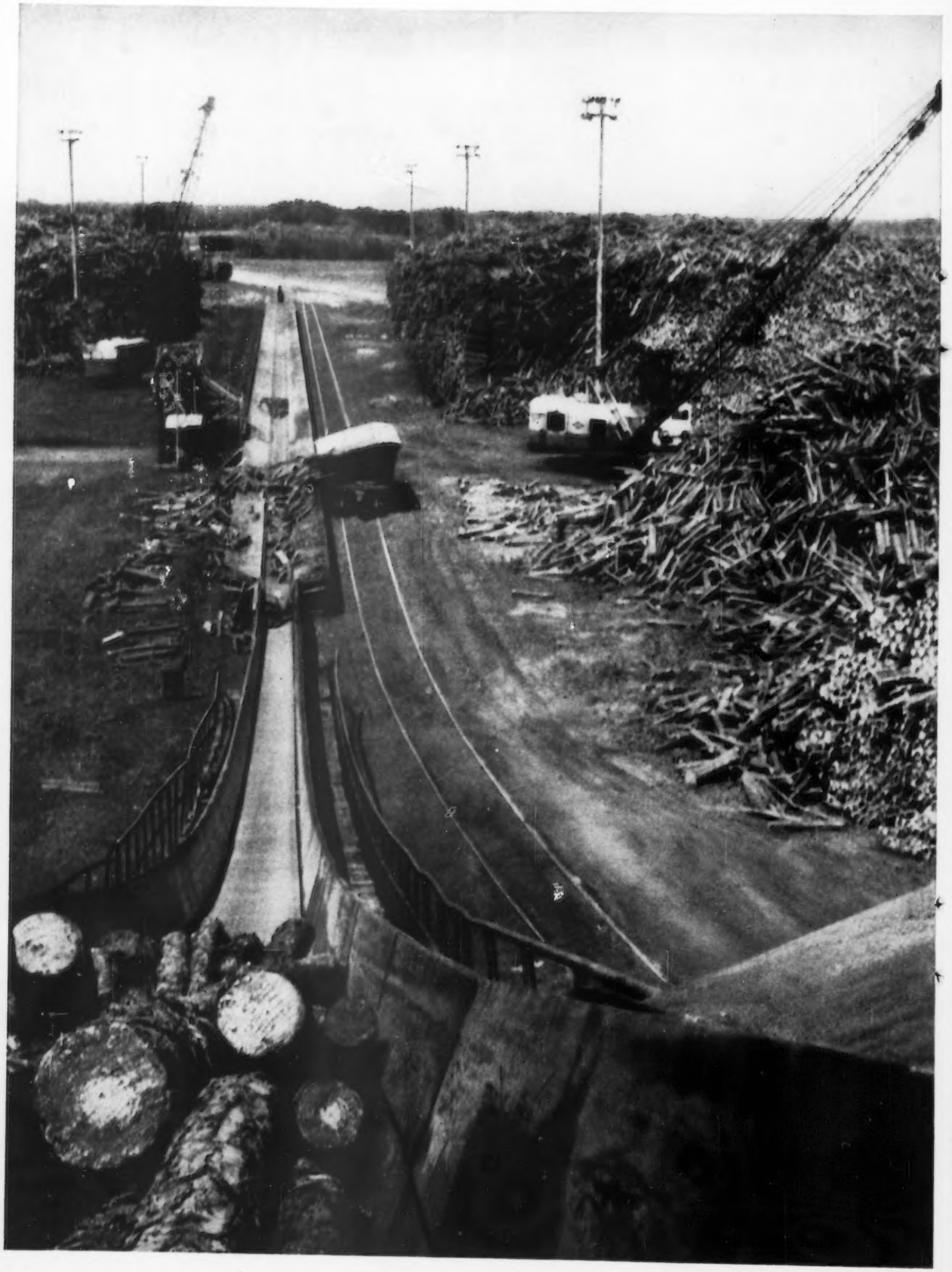
Sulphur Producing Units: Newgulf, Texas • Spindletop, Texas • Moss Bluff, Texas • Fannett, Texas • Worland, Wyoming • Okotoks, Alberta, Canada



How to reduce mighty forests to a pulp!

After fourteen months of brutal punishment, Hewitt-Robins conveyor belt of Enka high-tenacity rayon proves its superiority!

At their Georgia installation, the Owens-Illinois Glass Company moves 325,000 tons of pulpwood a day. These logs travel 920 feet on Hewitt-Robins conveyor belting.

When the logs are loaded onto the belt by crane and side dump car, the impact is severe. That's why Owens-Illinois ordered Hewitt-Robins conveyor belting made of new high-tenacity Enka rayon. In the past fourteen months, this belt has moved a total of almost 100 million tons of logs! After this steady, punishing operation, the Hewitt-Robins conveyor belt shows no visible signs of damage.

It takes much more than the severe impact of jobs like this to damage a conveyor belt made of Enka high-tenacity rayon. Hewitt-Robins knows this. That's why, year after year, they continue to specify high-tenacity, low-cost Enka rayon. High-tenacity Enka rayon is made stronger to last longer.

Pound for pound, Enka rayon is your best value in industrial yarn:

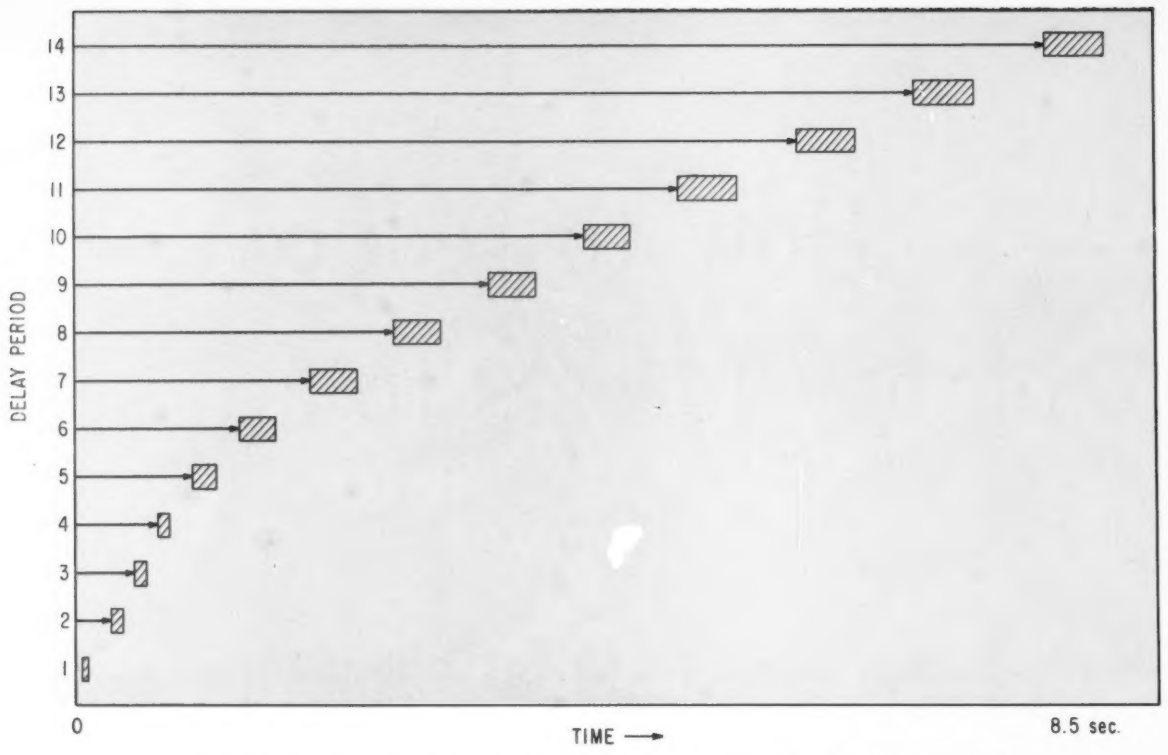
Greater strength • More elasticity • Increased heat and humidity resistance • Higher safety factor • More economy • Superior flexibility Better shock absorbency • Longer service • Less maintenance.

Specify Enka high-tenacity rayon yarns for industrial rubber products, chafer fabrics for truck and passenger tires, heavy-duty sewing thread for multi-wall bag closings and many other vital end-use applications.

Write for Hewitt-Robins brochure on C/R conveyor belting of high-tenacity rayon and cotton. It gives technical data on strength and other characteristics of belting made with cotton-rayon fabric. Write Hewitt-Robins, Stamford, Conn. Ask for bulletin 1-16A.

ENKA high-tenacity rayon for industry

® American Enka Corporation, 530 Fifth Avenue, New York 36, N. Y.
Leading producer of yarns and fibers for apparel, home and industry and Tyrex® viscose tire yarn.



This chart shows how you get a new kind of accuracy with Du Pont Acudet® Delay Electric Blasting Caps.

New Du Pont Delay Electric Blasting Caps

eliminate all possibility of overlap...

provide ample time for rock movement between periods

Du Pont's new series of delay electric blasting caps is made to fire with a definite time gap between the slowest cap of any period and the fastest cap of the next highest period. This not only eliminates all possibility of overlap, but also provides ample time for rock movement between periods. This makes the Du Pont Acudet Delay a major forward step in delay blasting control. Manufactured by mechanical assembly to closer timing tolerances than ever before possible, this new series assures a positive time gap of 1/10 to 1/2 second (see the graph above) between periods through the entire series of 14 delays.

The timing of each period and the length of the time gap between periods have been carefully selected to give optimum blasting results under all conditions. For instance, the time gap between the first and second delays is made long enough to insure the rock from the cut being out of the way before the first relievers go.

In the few months that they have been in the field, Du Pont Acudet Delays have been widely and enthusiastically accepted. Experience in a variety of operations has confirmed these advantages:

1. **Less bootleg**—more advance per round
2. **More uniform fragmentation**—easier mucking
3. **Less overbreak**—better shearing action
4. **Shorter shells**—easier to make primers
5. **Aluminum shells**—corrosion resistant
6. **First period fires in 1/40 second**—no need for special timing or circuit breaking equipment.

Like all other Du Pont Electric Blasting Caps Acudet Delays are mechanically assembled with nylon plastic insulation, rubber plug closures, and shielded shunts.

Ask your Du Pont representative *now* for detailed information on the phenomenal accuracy of Acudet Delays and what this means for you in your operation.

Call him direct or write to Du Pont, Explosives Department, 6440 Nemours Building, Wilmington 98, Delaware.

DU PONT REG. U. S. PAT. OFF. **EXPLOSIVES**

BETTER THINGS FOR BETTER LIVING...*through Chemistry*

Nevada (*Continued*)

Belmont Mine Co. is carrying out an extensive sampling operation at its Eldorado South property at Belmont in Nye County. The work is in preparation for production. A total of 16 men are employed at the mine and recently completed drifting operations from the incline shaft at the 1,000-ft level. Water head has dropped to 100 gpm and pumping operations are handling it with no trouble. Clin Twitchell, geologist, has been retained to check the various ore bodies. Walter Simmons is the firm's general manager, and is in charge of the reactivation of the old property.

Bognadich Development Co. has 28 men employed in northern Elko County producing gold-silver ore and building a mill. Mining operations are in progress in the Cold Creek and Rosebud Mountain area where 20 men are producing large tonnages of ore and hauling it to a stockpile at Mountain City for later mill processing. An eight-man crew is constructing the mill near Mountain City and target date for operation was set for Jan. 1, 1960. The company expects to operate the mill 24 hours daily, and it will have a capacity of 75 tpd. The installation will consist of an ore stockpiling area, bins, mill, settling vat, tailings pond, scales and assay office. Custom ore will also be handled when operations start. Special use permit from the U.S. Forest Service was obtained for the mill and tailings pond site, and application has been filed for permit for a well, pipe line and reservoir.

Dr. Joe Beasley Jr., formerly of Kansas City, Mo., and now of Winnemucca has leased and taken an option on the Sheba mine in Pershing County. Owners are Charles Green and his sister Katherine Seymour, of Mill City. During November, five men were employed at the site carrying out an extensive development project. The mine, which was a big producer of silver-gold ore in the early 1900's lies in Star Canyon of the Humboldt range 30 miles southeast of Winnemucca. Beasley reports that an encouraging amount of ore has been located. The mine tracks have been relaid, lighting has been installed, and the road to the property has been improved. The men live in a trailer camp at the site of the former Star City.

McPherson Drilling Co., Montrose, Colo. has ten men in core drilling operations on beryllium property in Pole Canyon, near Mt. Washington in White Pine County. Work started late in October after reports of the discovery of beryllium in the mine which formerly had been explored for silver-zinc and tungsten ores.

Reliable Meat Co. is producing a good output of barium ore from its leased property in the Northumberland district of Nye County 75 miles north of Tonopah. The mine lies at high elevation in the Toquima range, and three men are employed on the underground operation. Edward L. Hueck, president of the firm, is in active charge of the work.

ANY WAY YOU LOOK AT IT...

NEW

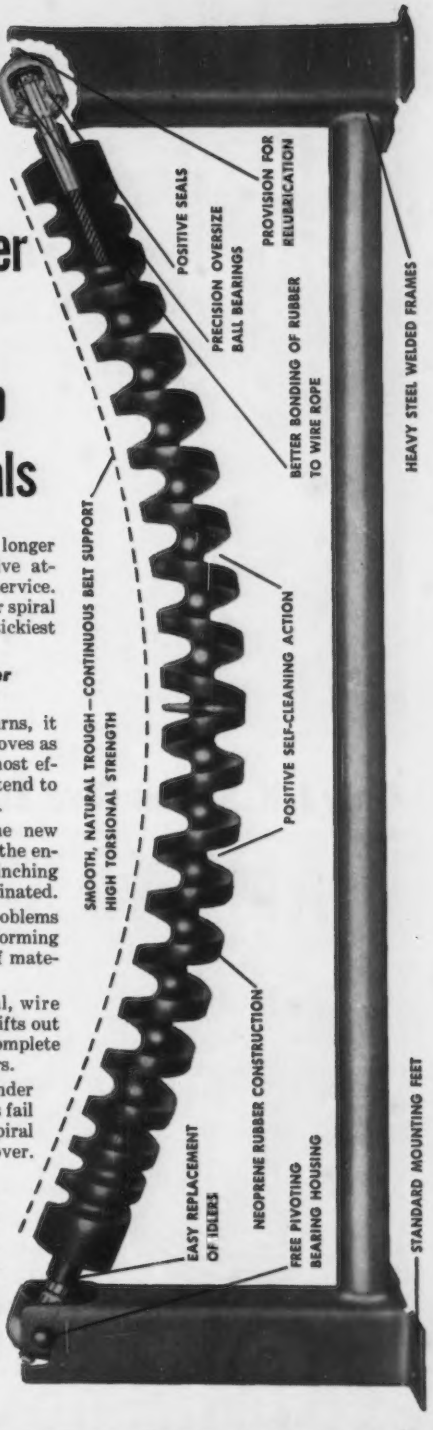
Rubber Spiral Idler lasts far longer, prevents build-up of sticky materials

This new rubber spiral idler lasts far longer than conventional idlers in corrosive atmospheres or exceptionally abrasive service. And its exclusive self-cleaning rubber spiral prevents build-up of even the stickiest materials.

Here are some of the rubber spiral idler's advantages:

- **SELF CLEANING.** As the spiral turns, it "works" any material out of the grooves as they change shape. This action is most effective with sticky materials which tend to build up on common types of idlers.
- **CONTINUOUS BELT SUPPORT.** The new rubber spiral design "moves" along the entire width of the belt; therefore, pinching and sharp bending of the belt are eliminated.
- **SELF TRAINING.** Belt training problems are greatly reduced by readily conforming rubber spiral, and by elimination of material build-up.
- **EASY REPLACEMENT.** The spiral, wire rope, and bearing assembly simply lifts out of its brackets—no tools needed. Complete idler fits standard conveyer stringers.
- **TRUE OPERATING ECONOMY.** Under conditions where conventional idlers fail prematurely, the Hewitt-Robins spiral idler will pay for itself many times over.

Deliveries of this revolutionary new idler are now being made in 18, 24, 30, and 36 inch belt sizes. In addition to the type shown, it is also furnished with a spreader frame for use in wire rope conveyor systems. For further information check your H-R distributor, or write Hewitt-Robins, Stamford, Connecticut. Ask for Bulletin 1-16.



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Newest and Best In Diamond Drill Bits For Every Drilling Need

Including: Surface set and impregnated coring bits—concave bits—pilot bits—thin wall coring bits—reaming shells—casing bits.

Few things vary as much in quality as industrial diamonds. No one knows this better than J. K. Smit & Sons, Inc., where a veteran staff of specialists select the diamonds that give J.K.S. Diamond Drill Bits their exceptional cutting properties and long life.

Many of these men, and their fathers before them, have spent their lives with J. K. Smit as diamond experts. Theirs is one of the rarest skills in the world . . . a skill that makes a continuous contribution to the worldwide reputation of J.K.S. Diamond Drill Bits for giving more footage in every type of formation at lowest costs.

Send today for J.K.S. Catalog #60, or see your nearest field representative.

First In Experience and Service

J. K. Smit & Sons, Inc.

Home Office and Plant

Murray Hill New Jersey

TENNESSEE

American Zinc Co. of Tennessee is reopening the Grasselli mine at New Market. H. I. Young, president, announced that the mine was to be in production by Jan. 1, 1960.

Grasselli mine was closed in December 1957 because of the slump of zinc prices to 10¢ per pound. At the time the mine was closed, it was producing approximately 700 tpd of zinc ore.

Geologists from New Jersey Zinc Co.'s Jefferson City office are examining the Wilkins Creek pyrrhotite prospect in Haywood County, N.C. The pyrrhotite in this prospect is known to contain small amounts of Co, Ni and Ag.

Tennessee Corp.'s net earnings for the quarter ending Sept. 30, were $1,921,400, the highest figure for any third quarter in the company's history, the corporation said in an interim report.

Tennessee Copper Co., with iron sinter, sulphuric acid, copper and other products producing units at Ducktown, Copperhill and Isabella, is a division of the corporation. About 1,800 currently are employed by the plants.

The report said the corporation's Copperhill plant operated at capacity throughout the third quarter to satisfy the continuing strong demand for sulphuric acid, and shipments of iron sinter and other products were at a high level.

UTAH

Utah Construction & Mining Co. proposes to prospect in Utah's Brighton district for iron ore. The Brighton area now largely a ski resort, is only about 18 miles east of Salt Lake City in the Wasatch Mts.

U-C confirmed that it had proposed lease and option (to buy) the claims of Great Western Mines, Inc. and Miller Hill Mining Co., both of Salt Lake City.

Richard Knight, Salt Lake City, Great Western president, added that U-C promised to spend a minimum of $70,000 in geophysical examination of Great Western's 116 claims near Lake Mary in the Brighton District. Other funds would be spent in similar examination and core drilling on the 33 contiguous Miller Hill claims.

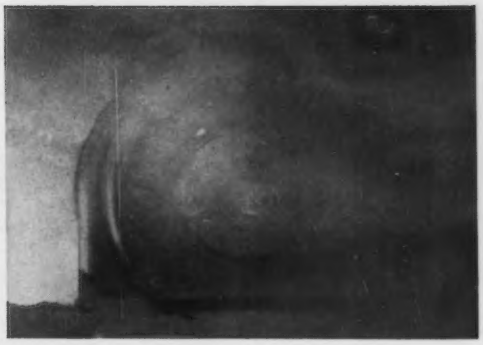
Mr. Knight said U-C was interested only in properties amenable to open pit mining of iron ore. The firm has been checking these claims in past several years, he added, and has evidenced interest in a "huge iron blow out" on the Great Western properties.

The lease and option offered by U-C involves payment of a straight ten per cent royalty on all metals other than iron and payment of a 25 cent a (dry) ton on iron ore.

Option to purchase involves a payment of $2.25-million.

Howe Sound Co.'s subsidiary, Calera Mining Co., expects to complete sale of its multi-million dollar cobalt refinery

PICKLED in a 4% brine solution!



CHOKED
in a tornado of abrasive dust!

FROZEN
for weeks at 75° C below zero!

BURIED ALIVE
in thick, sluggish mud!

nothing . . . but nothing stops Super-Seal open-type motors

Thanks to exclusive Poxeal and Silco-Flex insulations, Super-Seal motors have shown endurances that even enclosed motors couldn't match. Results and reasons available from your A-C representative or distributor. Or write General Products Division, Milwaukee 1, Wisconsin

ALLIS-CHALMERS A-C A-1151

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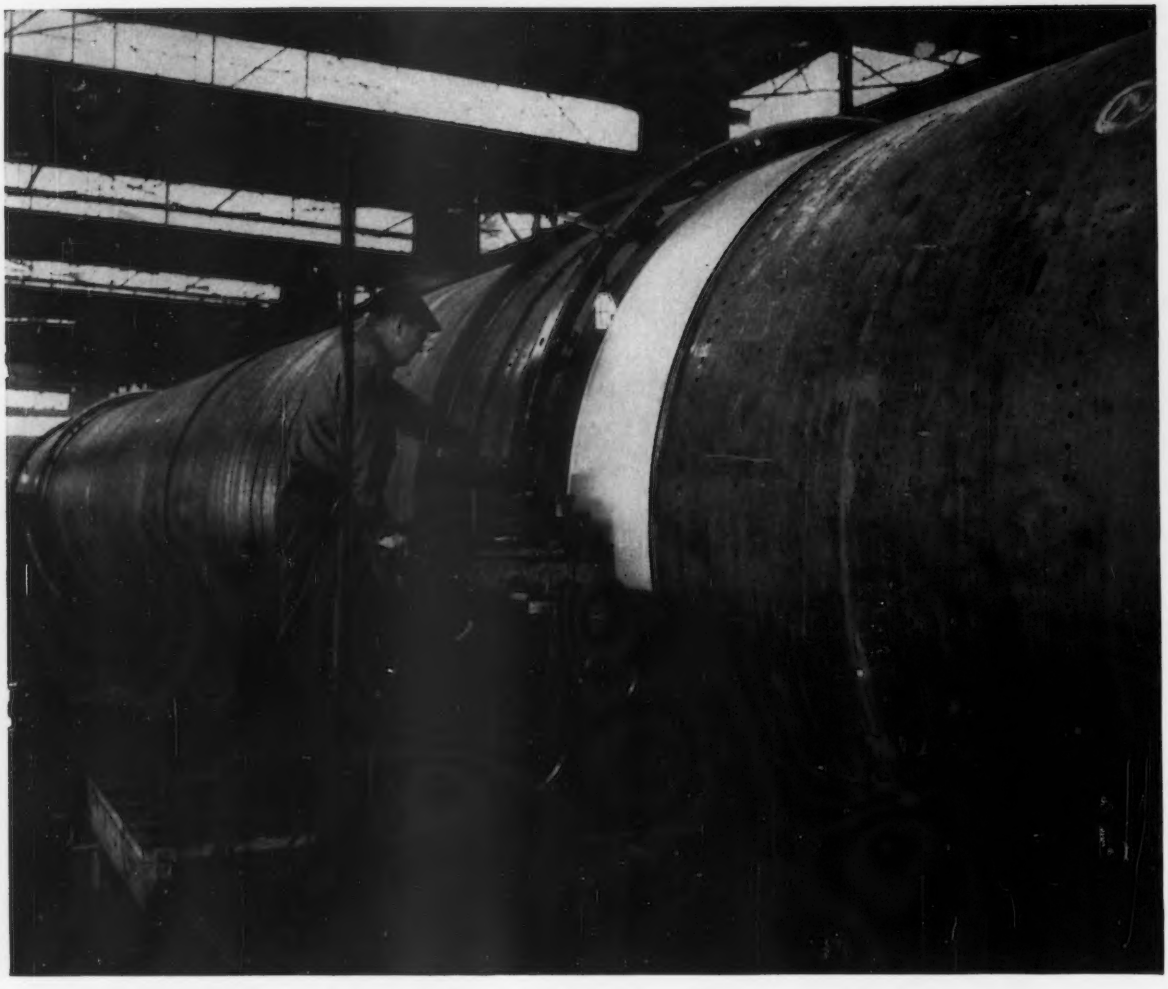

Louisville Dryer—10 feet in diameter, 10 stories long!

Turn a ten story building on its side, and there'd be room to spare on either end of this huge pit lathe at Sharon, Pennsylvania where this 10′ x 110′ Louisville Dryer was fabricated.

This lathe is used for machining the reinforcing bands onto which are mounted the forged steel tires. This careful workmanship assures concentricity of the completed dryer shell—a primary factor in efficient seal operation.

Every Louisville Dryer is especially designed, manufactured, assembled and installed for its specific task.

If you have a problem involving process equipment, call or write our equipment specialist in your area. Here, as in so many fields, you'll find IT PAYS TO PLAN WITH GENERAL AMERICAN.

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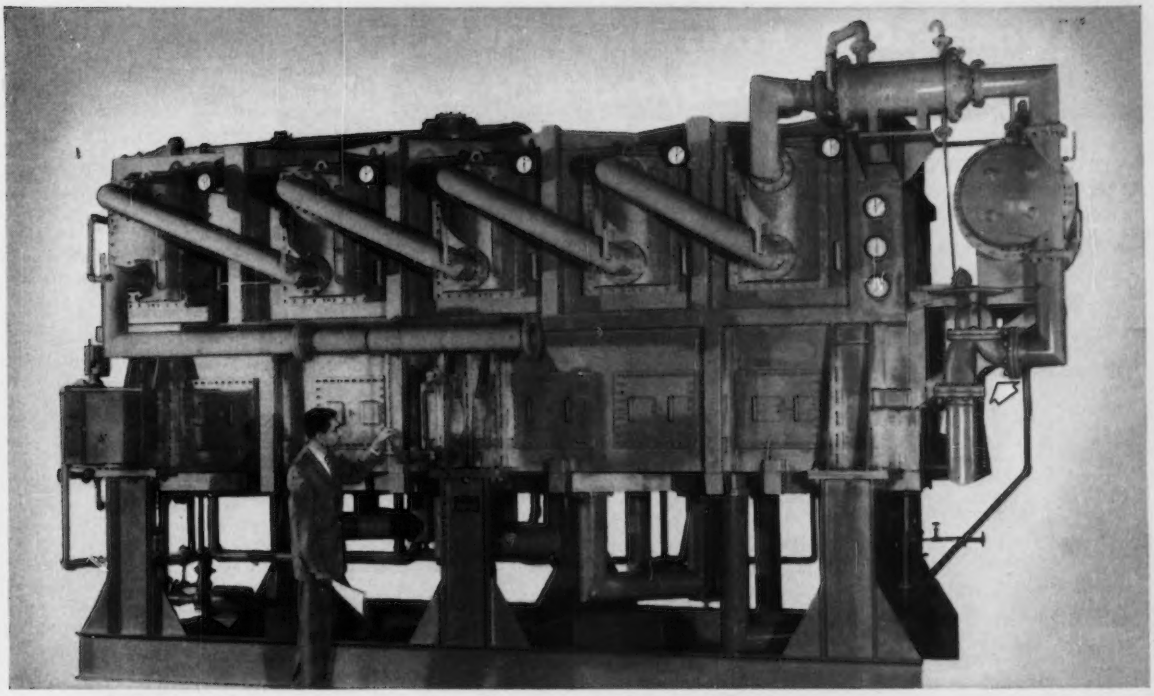
GENERAL AMERICAN TRANSPORTATION CORPORATION
135 South LaSalle Street, Chicago 3, Illinois
Offices in Principal Cities
In Canada: Canadian Locomotive Co., Ltd., Kingston, Ontario

Louisville Dryers



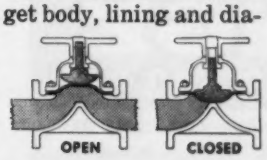
ON LAND At Salinas, a tourist center in Ecuador, this Cleaver-Brooks Flash Evaporator delivers 50,000 gallons of pure, distilled water every 24 hours. It is equipped with two 6", rubber lined, weir-type Grinnell-Saunders Diaphragm Valves — only one of which can be seen from this view.

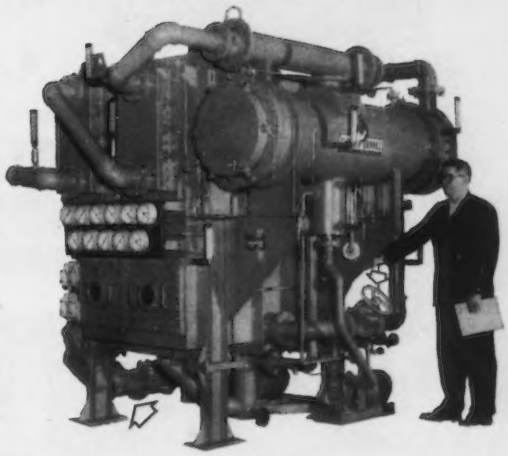
Grinnell-Saunders Diaphragm Valves help convert salt water to fresh water

You can convert sea water to fresh water, in abundant supply, on land . . . or on shipboard, with flash evaporators made by Cleaver-Brooks Special Products, Inc., Waukesha, Wisconsin. Grinnell-Saunders Diaphragm Valves are used as original equipment on these distillation units because they offer positive, leak-tight closure; flow control in throttling position; corrosion-resistance.

You'll find Grinnell-Saunders valves widely used in other fields, too . . . petroleum, papermaking, chemical, food, compressed air . . . to mention a few.

The operating principle of the Grinnell valve is the feature which makes it so adaptable. The diaphragm lifts high for streamline flow in either direction; seals tight for positive closure against grit, scale, solid matter, pressure or vacuum. Bonnet mechanism is completely isolated at all times from the fluid in the line by the diaphragm, preventing corrosion and contamination. Smooth passage, without pockets, eliminates trapping of solids and reduces frictional resistance. And you can get body, lining and diaphragm materials to meet your particular service conditions. Get *all* the facts. Write Grinnell Company, Providence 1, R. I.





AT SEA The nuclear powered NS Savannah has two 16,000 gallons-per-day Cleaver-Brooks distillation units to supply the entire water requirements of crew and machinery. Each unit has two 4" Grinnell-Saunders Straightway Valves of ductile iron.

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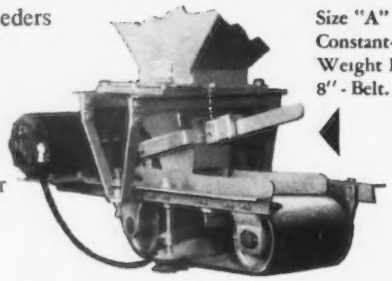
Branch Warehouses and Distributors From Coast To Coast

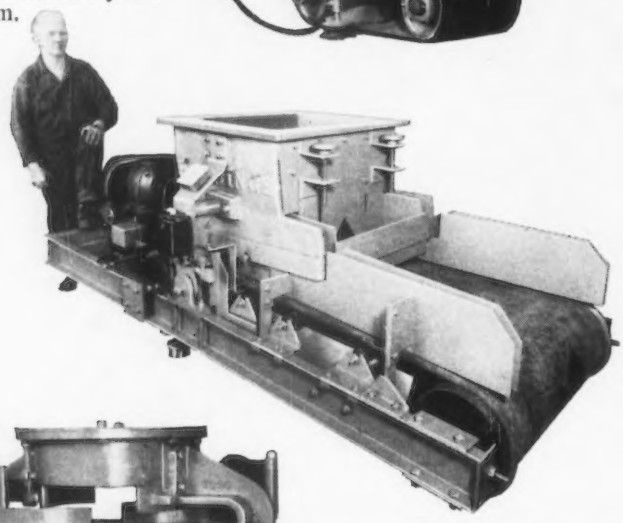
From 100 Pounds/hour To 200 Tons/hour

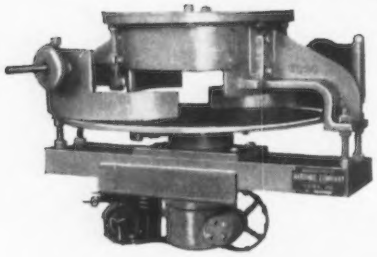
All **HARDINGE** Feeders are suspended from the feed bin which:

- Eliminates costly feeder support structure
- Provides accessibility to equipment following feeder
- Requires extremely low head room.



Size "A" Constant-Weight Feeder, 8" - Belt.

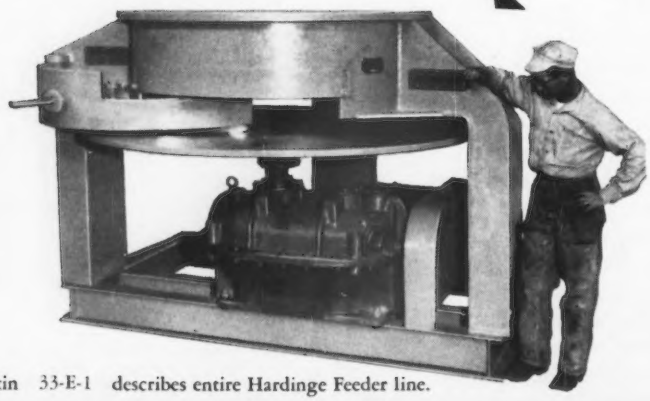




Size "D" Constant-Weight Feeder, 36" - Belt.

30" Disc Feeder

84" Disc Feeder



Bulletin 33-E-1 describes entire Hardinge Feeder line.

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Utah *(Continued)*

at Garfield in next few months.

The last cobalt was run through the unit southwest of Salt Lake City Nov. 13.

Once employing some 132 men, the refinery was part of a post World War II complex involving underground and open pit mining of arsenical, cobalt-copper ores, at Cobalt, Ida. The ores also were beneficiated at Cobalt, Lemhi County, and shipped by truck to Garfield.

In all, Howe Sound placed more than $12-million in the cobalt complex, one of the largest in the Western Hemisphere, at urging of the U.S. Government which at the time declared the metal strategic and essential and signed purchase contracts.

A spokesman for Calera told E&MJ that following a decision by the Office of Civil & Defense Mobilization that domestically-produced cobalt was no longer of any strategic interest to the U.S. Government, Howe Sound determined to get out of the cobalt business.

Mining properties have been closed permanently at Cobalt. Even the milling of some of the tailings and waste material for copper values is scheduled to cease shortly at the Idaho plant.

"We definitely will not reopen the mines" even for the recovery of the copper ores, as was once considered by the firm, E&MJ was told.

A number of "bids" for the Garfield refinery are being considered. While identities of interested parties were not disclosed, it appears interest is stimulated more by those seeking conversion of the plant and site to chemicals production than from any desire to continue production of cobalt metal. Location is considered too far inland for processing of foreign produced cobalt concentrates.

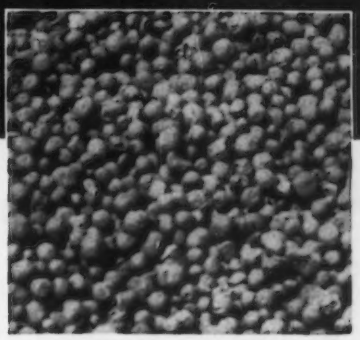
Securities dealers in Houston and Salt Lake City have identified Armour & Co., Chicago meat packers, as the new marketing partner with Delhi-Taylor Oil Corp., seeking development of a huge potash property at Cane Creek, southwest of Moab. (E&MJ, October, p19.)

Delhi-Taylor had announced in past that it was seeking a marketing outlet for the potash and that it would set up a joint firm with the marketing company. The jointly held corporation would mine, beneficiate and move to railhead the potash produced at Cane Creek.

The Dallas, Tex. oil company, has developed reserves by drilling capable of supporting a 1,000 tpd mill for 41 years of operations. The company also has proved on indicated basis more potash than is contained at present in the Carlsbad, N.M. district, engineers say.

The potash is of high quality and can be mined with shaft to about 2,200 ft. The deposit is located on U.S. permits in the canyon of the Colorado River just below scenic Deadhorse Point.

Uranium Reduction Co. has placed in operation at cost of $2.5-million its alkaline leach, resin-in-pulp circuit for the production of yellow cake, at Moab.



Typical Mesabi Range material: abrasive, heavy

Rubber-tired machines the only practical solution

From a distance it looks like any other stockpiled material. Then you come close and you see *this is something different*—something that combines many of the worst characteristics of sand, gravel, even rock. It's abrasive. Dead. Heavy. You've heard the name. It's *taconite!* Processed taconite! Round pellets, varying from a half-inch to three-fourths inch in diameter, blue-gray in color, 63% pure iron.

When rubber-tired machines can handle such material *successfully*—day in and day out—with rubber's obvious advantages of mobility and no track wear—that's real news for maintenance-minded firms that have almost *any sort* of stockpile or feeding problem.

This Minnesota taconite plant has *five rubber-tired Michigans.* These include a 2¾ yd Model 175A, a 2 yd 125A, and two 1¼ yd 75A Tractor Shovels . . . and the 262 hp Model 280 Tractor Dozer pictured. The Tractor Dozer exemplifies Michigan advantages . . .

Advantage No. 1—Tire Life

This 56,000 lb machine started work about a year ago. To date, its tires show virtually no wear. The machine does a variety of jobs. For example . . .

Advantage No. 2—Mobility

1. Levels the multi-million ton taconite pellet and stockpiles. Machine works on 2-to-1 and 3-to-1 slopes, has surprised men on the job with its ability to climb steep grades on loose footing.

2. Cleans around the 10-yard pellet-loading shovel. Major advantage in this operation is way Michigan's low-pressure tires don't crush the pellets . . . a real problem with crawlers.

3. Maintains haul roads.

4. Tows disabled trucks.

5. Cleans spillage around distant pellet plant. Unit gets to this assignment, 2 miles away, at 28 mph, travels under own power without waste of lowboy loading or unloading, does no damage to RR tracks or blacktop roads.

6. Cleans under hopper. Here, operator dozes normally until he accumulates load. Then he hydraulically pivots blade back, lifts material, turns and dumps outside of rail tracks.

Advantage No. 3—Dependability

Key to Michigan success, however, has been dependability! Entire power train of each machine—torque converter, power shift transmission, planetary axles—is designed and built by Clark, specifically engineered to give more usable power and traction than you've ever seen on rubber. Get the proof of a demonstration. Four Michigan Tractor Dozer models—162 to 600 hp—eight Michigan Tractor Shovels—16 cu ft to 6 cu yds—to choose from.

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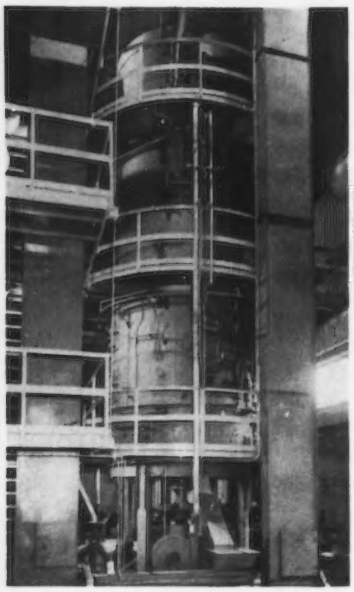

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Roasting Zinc Ores
Calcining of Basic Alum, Clays, Foundry Sand, Carbon, etc.
Incineration of Sewage

Chloridizing Roast

Roasting Uranium-Vanadium Ores

Reduction Roast

Decomposition of Oil Sludge
Lime Burning
Manganese Reduction

Drying

Drying Uranium-Oxide Precipitate
Drying Copper Concentrates
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Many other applications are possible ***because of the flexibility in construction and operation of the Skinner Furnace...***

2 to 14 hearths
4'0" to 23'6" dia.
22 to 4000 sq. ft. hearth area
Direct or indirect fired with coal, oil or gas
Variable rate of feed and retention time
Up or down draft
Handles any solids.. slimy, sticky, loose, coarse
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200° F. to 2000° F... precise control of process temperature
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Utah *(Continued)*

A new formula for assessing value of uranium mines is proposed by the Utah State Tax Commission.

The agency said the present system is inadequate because it frequently puts an unfair burden on the taxpayer, the local governments, state and mine operator.

The problem with uranium results from fact that many mines play out within a year or two.

At present, uranium mines are assessed as are other metal mines—according to a net proceeds formula established by law.

Under this formula, the value of a mine is twice the average net proceeds of the three preceding years.

But when a major uranium mine which produced considerable tonnages of ore is sold or leased to scavenger operators, the new operators are faced with the past two years assessment.

They cannot pay this assessment—and as a result the taxing authority cannot collect what would ordinarily have been due them.

WASHINGTON

Thomas Consolidated Mines, Inc., of Spokane, has completed a two-phase study of the South Penn property in the Republic gold mining district.

David E. Watson, president, said that trenching and sampling was done to determine the total width of a mineralized zone at the site of open pit operations several years ago.

The work showed the zone extends up to 75 ft beyond the pit operations, which had been carried out over a 200-ft width in some spots.

He said that metallurgical tests indicated the ore is amenable to cyaniding. The property once produced some 40,000 tons of ore.

Pitney Butte Mining and Smelting Co., Inc., has been organized to take over the assets of Spokane Molybdenum Mines, north of Davenport.

The new firm, incorporated in Delaware, is headed by Henry A. Trinke, Moses Lake, president. Florence Bayley, Odessa, is vice president.

WYOMING

The Wyoming State Highway Dept. has obtained right-of-way for relocating State Highway 28 around a proposed multi-million dollar iron ore upgrading mill at Atlantic City.

Columbia-Geneva Div. of U. S. Steel will pay for relocating about three miles of highway around settling ponds for its proposed mill if it decides to go ahead with the project.

Columbia-Geneva has been conducting tests in the area for the past two years on the feasibility of mining low grade taconite depo[illegible]pgrading at mill, and shipping th[illegible]to furnaces at Provo, Utah.

emplifies Michigan advantages . . .

to RR tracks or blacktop roads.

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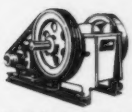
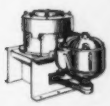


4"x 6" Massco Laboratory Jaw Crusher

Welded steel frame; manganese steel jaw and cheek plates; bronze bushed bearings; smooth jaws give better product and easier cleaning. Adjust for plate wear and product size by convenient hand wheel adjustment.

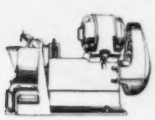


6" and 10" Massco Gy-Roll Reduction Crusher

Reduces ½" feed to as fine as 10 mesh in single pass. High capacity, low power consumption.

Laboratory Crushing Rolls

Sizes (Diameter x width): 8"x 4", 10"x 6", 10"x 8", 12"x 10" and 12" x 12". Adjustable roll space setting up to ¾". Double V-belt drive. Heavy, cast Meehanite frame absorbs vibration, results in long life.



Massco-McCool Pulverizers

Disc type grinder with a planetery movement. No gears. Will grind ¼" to 150 mesh in one pass.

Marcy Pulp Density Scale

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OFFICES AND AGENTS IN PRINCIPAL CITIES

Uranium operators in the Gas Hills area have agreed to put up about $90,000 a year to supplement Federal, state and county funds for paving and maintaining the Riverton-Gas Hills road.

Under the agreement, the uranium operators and other users of the highway will match about $90,000 of county funds each year. An additional $320,000 in state and Federal funds will be allocated each year for a five-year program to improve the road.

The Gas Hills area is about 60 miles east of Riverton. A road from the Gas Hills area to Jeffrey City is also contemplated in the 80-mile network of roads.

Green Mountain Uranium Co., a subsidiary of Phelps Dodge Corp., has completed about 1500 ft of underground workings on its uranium mine in the Crooks Gap area.

Some ore encountered has been mined, but full-scale operations await completion of development work. The ore will be shipped to the Western Nuclear mill at Jeffrey City.

Uranium ore is being received at the Susquehanna-Western mill in Riverton from the Thunderbird No. 9 claim on the P-C Mining Co. property in the east Gas Hills.

Robert W. Adams, president of Western Nuclear Inc., is operating the property. P-C ore was allocated to the Riverton mill under an allocation system worked out by the AEC and operators in the area.

IN CANADA

ALBERTA

In a surprising switch, what began as a crude oil wildcat well at Panther River in the foothills region of Alberta has become a mining venture, with Alberta Pacific Sulfur Co., Ltd., claiming it can produce 350,000 tons of sulphur per year from an estimated 6-trillion cubic ft reserves of natural gas running to 87% hydrogen sulphide. This marks the first occasion in western Canada drilling that natural gas, and not sulphur, becomes the potential by-product.

SASKATCHEWAN

Interprovincial Steel Corp., Ltd., reports it has 36-million tons of proven iron ore grading 30% iron in its holdings at Choiceland 60 miles east of the city of Prince Albert. Also reported, as a result of tests last summer and fall from drilling, are probable reserves in excess of 100-million tons in property the company has under option.

The company owns and operates a mill and steel pipe fabricating plant in Regina, and has announced plans to develop the iron ore property as western Canada markets expand.

Potash Co. of America's new mine 15

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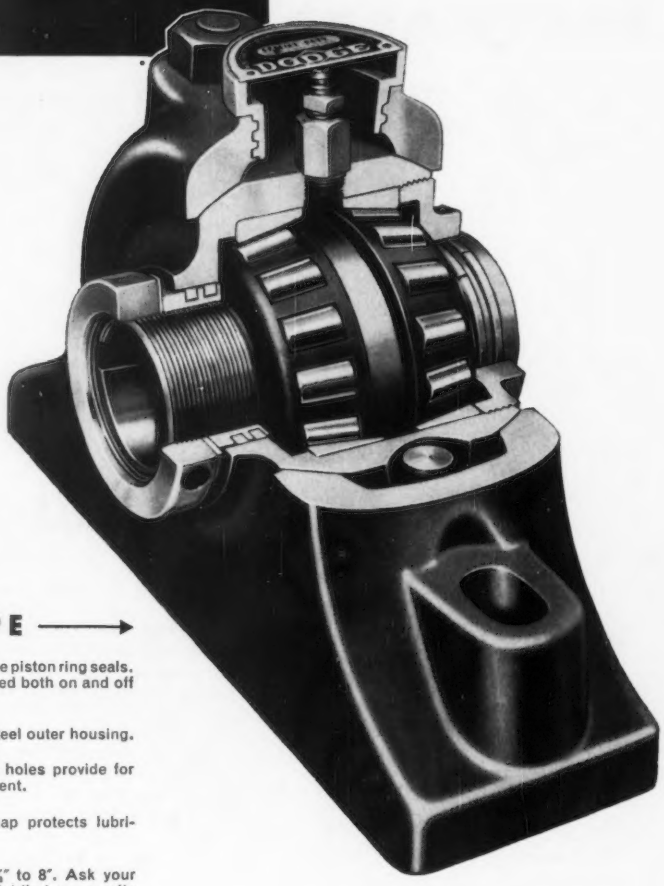

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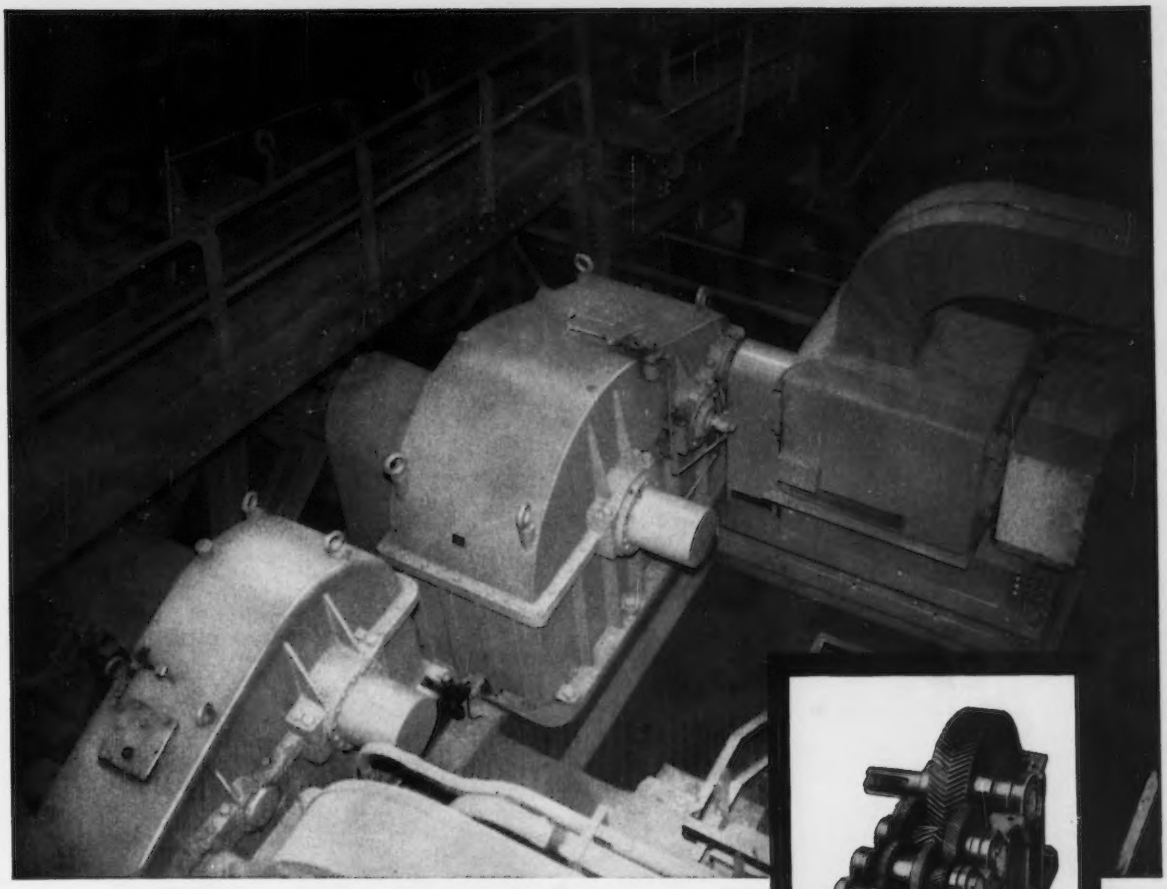

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In performance, these reducers have no equal. Gearing is designed to the needs of each application and symmetrically arranged in the housing. Hence, bearings on each shaft carry equal loads, shaft deflections are minimized, bearings and gearing have higher shock load capacity.

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Coal in Kentucky . . . Uranium on the Colorado plateau . . . Bauxite in the Ozarks . . . Limestone in Pennsylvania . . . Copper in Montana . . . These are but a few examples of the extent of our operations. Throughout the United States and even in many foreign countries we have successfully explored and proved ore reserves for our many customers, and where normal methods have failed, special techniques have been developed. In the Gas Hills Area of Wyoming, for example, we successfully cored the loose sand and siltstone where others had failed by "freezing" the material. Our personnel and equipment are stationed throughout the United States awaiting your call.

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Saskatchewan *(Continued)*

miles east of Saskatoon will be closed until March because of water seepage in the shaft, Houston Clarke, vice-president and manager, stated. The company will attempt to remedy the condition by pumping cement into the formation behind the walls of the 3300-ft shaft.

NEW BRUNSWICK

The pace of exploration in New Brunswick is stepping up as lead and zinc prices show some firmness in recent weeks. The Bathurst-Newcastle area in particular is busy, with 15 companies outlining known mineral deposits or looking for new ones.

Consolidated Mining and Smelting Co. is sinking a shaft and erecting a headframe on its Wedge property 32 miles south of Bathurst. The company is also diamond drilling on its California Lake holdings and has staked 46 claims in one block in the Popelogan district of the Upsalquitch River.

Anaconda Co. (Canada), Ltd., is drilling in the Armstrong Brook area, and is also driving an adit on its Caribou property. Plans are to take the adit a total of 425 ft by year end.

Anthonian Mining Corp. is drilling its property southwest of Heath Steele mine, and Clearwater Mines, Ltd. is active on its Burchill Road holdings. New Jersey Zinc Co. is drilling in the Portage Lake area on a reportedly promising find. Noranda Mines, Ltd., has finished drilling in the Belladune area and is carrying on prospecting and geophysical work in the 9-Mile Brook and northwest Miramichi district.

McIntyre Porcupine Mines, Ltd., is line cutting, diamond drilling, and doing geophysical work on its Belladune properties. Madsen Red Lake Gold Mines, Ltd., is prospecting in the Belladune area and N. L. Doucet Co. has completed drilling and geophysical work on the South Nigadoo River. Texas Gulf Sulphur has staked 100 new claims in the Charlo and Bald Mountain areas.

NORTHWEST TERRITORIES

A record 110,000 tons of supplies and equipment have been delivered to Canada's northern mining and other outposts in Northwest Territories this year. Earlier in the year it was estimated that about 85,000 tons would be delivered, in the June-October season.

Seventeen federal government icebreakers and freighters, 26 chartered commercial vessels, and 125 landing craft were involved. About 5,000 tons was delivered to western Arctic posts and the bulk to the eastern Arctic area.

Improved efficiency at Great Yellowknife Gold Mines, Ltd., has boosted recovery to the point where the company no longer qualifies for Canadian gov-

Bethlehem Rope Helps Them Scoop Up Taconite. Here you see an 8-yd shovel at Erie Mining Company, Hoyt Lakes, Minnesota, taking big bites into nature's stockpile of taconite. Because the ore is hard, and because of the limits of the primary crusher, the shovel is equipped with a 5-yd dipper. Two pieces of 1½-in. Bethlehem Wire Rope, 212 ft long, are used in the hoist line. The construction is 6 x 25 W improved plow steel, IWRC, Formset, one right lang lay and one left lang lay. Bethlehem 1⅛-in. rope, in the same construction, is also used for the crowd and haulback lines. This is the kind of tough, all-weather application where Bethlehem Wire Rope performs at its best.

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NWT (*Continued*)

ernment aid programs, states president A. J. Anderson. Plant and new equipment such as a low temperature roasting unit have now been written off.

A major tungsten deposit in the Mackenzie Mountains in Northwest Territories is being developed by Canada Tungsten Mining Corp., a new group including Highland Bell Ltd. of Vancouver; Leitch Gold Mines; Area Mines; Dome Mines; Ventures Ltd.; Lake Expanse Mines; J. J. Rankin; Karl Springer and several prospectors.

Giving promise of becoming "one of the world's biggest tungsten properties," the deposit is still open and its limits have not been found. The ore is in a flat deposit lying 1200 feet up the side of a mountain and lends itself to open-pit mining. Drilling has indicated 1,166,000 tons of ore averaging 2.18% tungsten trioxide.

Open-pit production may begin by the end of 1961. Production financing is estimated at about $5-million.

BRITISH COLUMBIA

Bethlehem Copper Corp. Ltd. is seeking $15-million to put its Highland Valley property into production, H. H. Huestis, president, announced following a report by Dr. B. S. W. Buffam, consulting geologist.

Dr. Buffam recommended initial milling rate of 7,500 tons of ore a day or 2.6-million tons a year as the optimum rate with the amount of ore in sight.

Ore estimates are 12.6-million tons grading .70% in the Jersey zone, and 5.5-million tons grading 1.15% in the East Jersey.

Camp McKinney Gold Mines Ltd. has 10,000 tons of ore from its Rock Creek property (grading more than 1 oz gold a ton) ready to ship to the Trail smelter of Consolidated Mining and Smelting Co. Ltd. First shipment was expected to move in December. The company expects to produce 50 tpd of ore.

ONTARIO

Upper Canada Mines, gold producer in the East Kirkland Lake area, has run into what appears to be a brand new ore structure in drifting and drilling on the bottom. or 4,525-ft. level. The zone, opened for a length of over 100 ft, is still open to the east. Muck samples from 79 cars taken from the drift averaged $17.01 per ton and from 130 cars $31.91 per ton. It is planned to resume shaft deepening early in the new year to open additional levels at 4,675 ft and 4,825 ft.

Northspan Uranium Mines is driving hard to open up ore for contract purposes from its two operating properties in the Elliot Lake area. Crosscutting from one of three levels being developed from the service shaft at the Lacnor property, has encountered a 14-ft thick-

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"Up to double the footage between sharpenings!"
"Premature rod breakage is almost non-existent!"
"40% more usable life—more resharpenings!"
"Bit and rod life are well above average!"
"Uncouple by hand all the time!"
*"More rigid—drills straighter holes!"**

**Names of men quoted available on request*

The comments above are actual quotes from project managers, job superintendents, and drill superintendents who have tested new Coromant rope-thread bits and steels. They've learned, on-the-job, the benefits they—and you—can expect!

For example: The new rope-thread (only two turns per inch) holds tight in use, yet permits hand uncoupling. Reports show that the time saved results in more footage drilled per shift. Bit footage is well above average too, with less loss of carbide inserts. Prime quality ore plus nickel-chrome alloy permits cold-rolling from billets for greater strength, life and rigidity. And only with Coromant rope-thread steels can you re-thread without heat treating, too. Do it yourself, or at any nearby machine shop.

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Ontario *(Continued)*

ness of ore averaging about 2.0 lb uranium oxide per ton. The main, or production shaft is being deepened to open a total of nine new levels, including the three being developed from the service shaft. Developments on the Panel property are also adding to available ore. The company has been purchasing ore from the Algom Quirke Lake mine to meet its contract requirements. It was expected that that would not be necessary after the first of the new year.

Pronto Uranium Mines is expected to fulfill its original contract for $55-million worth of uranium concentrates by the end of 1960 at the present rate of production. An extension to the original contract amounting to $12-million, or 1.5-million lb uranium oxide at $8 per lb. U.S. funds, will permit continuing operations at the current rate of output to March 1962. Earlier this year the company purchased the nearby copper property of Pater Uranium Mines. Approximately 1-million tons grading some 2% copper was indicated on the Pater ground. This ore can be concentrated in the present Pronto plant.

Algoma Ore Properties anticipates that iron ore shipments this year will establish a new all-time record. Shipments are expected to total some 1,890,000 tons, compared with the previous record of 1,577,220 tons in 1958.

Kukatush Mining Corp. (N.P.L.) Penhorwood township, Sudbury Mining Division, has completed 57,000 ft of drilling (AX core—1¼ in.) from Jan. 6 to Nov. 6, 1959. A body of iron-bearing rock of considerable tonnage has been defined by this drilling.

The work was carried out by Boyles Brothers Drilling Limited of Kirkland Lake with six drills in operation for much of the program.

The work was under the direction of Paul E. Pesonen, consulting engineer, and the field work supervised by Harold S. Gerson, consulting geologist.

QUEBEC

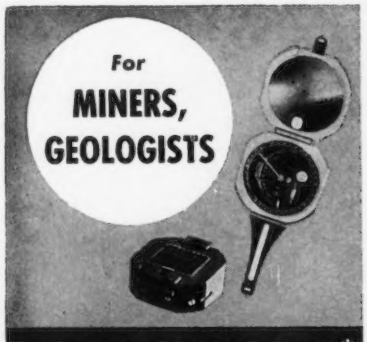
Hilton Mines is carrying out expansion of its iron operations north of Hull to increase production by some 33% early in 1960. The project, expected to be completed next April, is designed to boost plant capacity from its present 600,000 tons of iron pellets annually to around 800,000 tons. Operations were not affected by the lengthy steel strike in the U.S., although in normal times some 50% of the production goes to the U.S. The balance is sent to the Steel Company of Canada's plant at Hamilton.

Quebec Iron and Titanium Corp. is enjoying much better results this year with demand for its products showing a definite uptrend. Titanium slag sales for the current year are expected to equal the 1957 high of 231,179 tons. Pig iron sales are also increasing, reflecting improvement in range and quality. At present seven of eight furnaces are in operation at the Sorel smelter and this rate is expected to continue throughout 1960. Present rate of production calls for mining about 800,000 tons of ilmenite ore annually from the open pit operations in the Allard Lake area.

Molybdenite Corporation of Canada, Canada's only molybdenum producer, has increased production and ore reserves during the current year. Mill rate for the first nine months, 1959, averaged 663 tpd, up from 618 tpd in 1958, when output totalled 816,371 lb molybdenite. During 1959 the shaft was deepened by about 250 ft and exploration and development work is now in progress on two new levels.

Shaft sinking has started at the copper-zinc property of Consolidated Vauze Mines in the Noranda area. Plans call for the sinking of the three-compartment shaft to 750 ft and lateral work on several levels to open the south, or "B" zone, and to investigate the north zone by underground diamond drilling.

A thorough exploration and development program is getting started at the Chibougamau area gold property of Norbeau Mines. Contracts have been let for some 15,000 ft of diamond drilling and for a 1,000-ft adit to open the orebody. A contract is also to be let for the sinking of a three-compartment production shaft to 600 ft and 6,000 ft of lateral work.



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IN LATIN AMERICA

BRAZIL

Morro do Niquel, S.A. has been established in Sao Paulo, to mine a nickel ore deposit near Passos in the State of Minas Gerais. The mine has proven ore reserves for many years of continuous operation and is located close to a source of abundant electric power. Its yearly output is expected to be 2,400 tons of ferro-nickel at inception, ample to cover the present requirements of the Brazilian domestic consumption.

BOLIVIA

Cia. Estañifera del Brasil has presented the Bolivian Government with a formal proposal to erect a tin smelter in Bolivia.

The proposal says that the smelter plant, to be erected in Oruro at a cost of US $3-million, under the plans made by Brazilian technicians "would be similar to the one CED is operating at present in Volta Redonda." It adds the following:

1) The smelter would be established during the year of 1960.

2) It would beneficiate 3,300 short tons of mineral the first year, next year 6,600 tons and in the future, according to needs, 13,200 up to 19,800 tons.

3) The proposed smelter would be electric-power operated.

4) The required 220 tons "are for Brazilian internal consumption," while "the metal smelted in Bolivia would feed Latin-American markets."

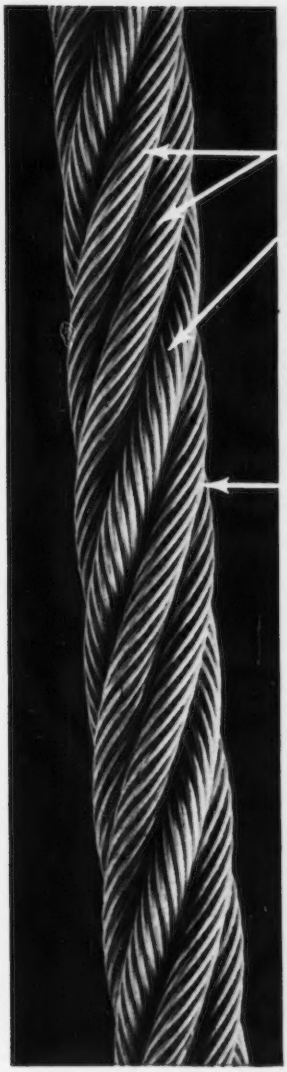
DOMINICAN REPUBLIC

Minera y Beneficiadora Falconbridge Dominicana, an American-Dominican enterprise, has announced a six months target for a pilot plant to handle the nickel deposits in Cibao region.

CHILE

El Salvador, the new Anaconda mine and mill that replaced the worked-out Potreillos, was officially inaugurated on the 12th of November by the Secretary of the Treasury and Mines Señor Roberto Vergara on behalf of the President of the Republic Senor Jorge Alessandri. The Anaconda Co. was represented by the chairman of the board Clyde E. Weed, by president Charles M. Brinckeroff, by the vice president in Chile, Rodolfo Michels, by the general manager of Andes Copper Mining Co., William J. Bennet and by the engineer in charge of construction, Steward Carpenter.

The new El Salvador mine is in the Andes range 17 miles from the Llanta



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Chile *(Continued)*

depot on the company's railroad from Pueblo Hundido to Potrerillos; Llanta and El Salvador being joined by a 17-mile paved road. The old smelter and camp at Potrerillos and El Salvador are also joined by a 20-mile road. El Salvador is at an altitude of 9300 ft above sea level and reserves stand at 380-million tons of 1.6% copper ore. The new flotation mill can handle 25,000 tpd of ore and at this rate of exploitation the mine will have a life of more than 40 years. The ore will be mined by the caving system and the concentrate hydraulically transported from the mill to the Llanta depot at 40% solids through a pipe. At Llanta, the concentrate is loaded into railroad cars and hauled to the Potrerillos smelter. Later on a new smelter will be constructed at Barquito, the Andes' port where the power station is located by the sea. The new mine and mill has a capacity of 100,000 tons of copper a year which is nearly three times what the old Potrerillos mine was producing.

All told $103-million have been spent in drilling and developing the mine, in the construction of the mill, camp and roads and in bringing in the water for the camp and mill.

Of the total cost of the project, almost $37-million were spent in Chile.

The Anaconda officials who came to Chile to attend the inauguration of El Salvador told the Secretary of the Treasury that it was possible that the new Andes Copper Smelter at Barquito might be started by the middle of 1960.

Marvis Corp. S.A. of Panama will subscribe $5.2-million to the Mantos Blancos Co. which has developed the mine and is building a 2,000 tpd leaching copper plant.

William H. Muller & Co., the Rotterdam shipping and mining concern, has sold its extensive iron ore deposits in Chile (Algarrobro concession) to the Chilean national steel concern, Compania de Acero del Pacific, at a price of $13 million, payable over 16 years.

Contrary to a previous preliminary arrangement, according to which the concessions would be operated jointly by Muller, the Chilean national company and American financiers, there will be no American interest. Muller will act as agent for the sale of the Algarrobro ore to be exported.

MEXICO

Aluminum Company of America will put up a $20-million aluminum plant in the State of Vera Cruz to produce 20,000 metric tons of aluminum yearly within two to three years.

An Alcoa executive in Mexico said bauxite would come from Alcoa sources in Dutch Guiana and/or Arkansas. The 20,000 ton figure is approximately what Mexico consumes right now in aluminum but that figure might jump to 30,000 tons by the time the plant is finished, the source said.

PERU

The first shipment of manganese ore from the Perené region of Eastern Peru —a token shipment of five tons—was trucked to Lima in November consigned to W. R. Grace & Co. This is the first of 500 tons of 57% manganese ore that has been sold to Grace. Further shipments will be made by truck and rail from the Perené area to Lima. Grace also has an option on a further 200,000 tons of manganese.

Credit for the discovery of the orebodies is due entirely to Eduardo Busso, a Peruvian prospector of Italian descent. Mr. Busso and an associate, Carlos Tizón, formed the Compania Manganeso Perené to exploit the deposit.

JAMAICA

The second alumina plant of Alumina Jamaica Ltd. near Ewarton went into operation during the fall of 1959. The new plant, begun in 1956, has an annual production capacity of 250,000 tons of alumina.

The bauxite for the new plant is brought to the plant on a specially built aerial ropeway from the mining area four and one-half miles away.

IN AUSTRALIA

Australia's biggest scheelite producer, King Island Scheelite Ltd. is reopening its mine but production will be on a limited scale unless and until tungsten prices regain some of their losses. A small contract was obtained to cover the next 12 months' output.

First tests on a plant scale have been arranged for bauxite from Western Australia and a parcel of 7,500 tons was provided from the Darling Range by Western Aluminium N.L. The material could, if suitable, replace imported Indonesian, Malayan and Indian bauxite in Australia's only aluminium plant in Tasmania.

IN THE PHILIPPINES

Surigao Consolidated has acquired three new copper properties in Mindanao on which considerable prospecting has already been done by the original owners. The company has also taken over two iron properties in Zamboanga del Sur believed to have considerable promise. Japanese engineers have reported favorably on them to their principals, who are expected to aid in production financing. The old mine at Surigao had an output in September valued at $65,000, from gold, silver, and lead. Otto F. Weber is president of the company.

Consolidated Mines, operated by Benguet Consolidated on a profit sharing basis, has signed a five-year contract for $5-million of refractory chrome ore annually to Refractory Ore S.A. of Panama. In October the property shipped 33,100 tons, valued at over $600,000.

Total mineral production in the Philippines for the 1958-9 fiscal year passed $100-million for the third consecutive year. The higher production was caused mainly by increases in sales of gold, up by $2.9-million; copper, up $6.5-million; iron, up $1.3-million. Sales of chrome ore were down $2-million.

IN AFRICA

Governments, individual prospectors and the huge gold-mining houses of the Witwatersrand are involved in an intensive search for minerals extending to the three territories of the Central African Federation — Southern and Northern Rhodesia and Nyasaland.

The tally of discoveries already made in recent months is an impressive one.

A rich mineral deposit found last year in the Belingwe Native Reserve in Southern Rhodesia are so important that they may lead to the country becoming the world's leading emerald producer. The prospectors have been bought out by the prominent international mining house, Rio Tinto, for a sum reported to be around £750,000 ($2,100,000).

Many reports have reached Salisbury —capital of Soutern Rhodesia—of widespread copper strikes in the valley of the Zambesi. One of the strikes is said to be in the Chirundu area and might well be the legendary "hill of copper" reported to exist there. There are unconfirmed reports that a South African prospector —J. A. Bester—working in this remote area has stumbled on great copper wealth and has sold his claim to the Anglo American Corp. for £500,000 ($1,400,000).

Prospectors and geologists employed by the big mining houses are all searching in this area. Among the companies involved are Rand Mines Exploration Co., Transvaal-Messina and the Anglo-Vaal Co.

Nickel claims found in the Gatooma area of Southern Rhodesia by a middle-aged Rand widow, Mrs. Magdalena Leslie, were sold to Rio Tinto for £250,000 ($700,000).

Other recent prospecting developments include asbestos, dolomite, platinum, phospates, and uranium.

Rio Tinto has added to its prospecting area in the Hartley district. Rhodesian Selection Trust Exploration Limited has applied for rights over an additional 7.5 sq miles in the same district.

Last year Southern Rhodesia alone had 4,342 licensed prospectors. The number of claim blocks registered in that period rose to a total of more than 10,000. These prospectors—almost all "little" men who pay their £1 fee—are seeking principally chrome, asbestos, copper, iron, limestone and nickel.

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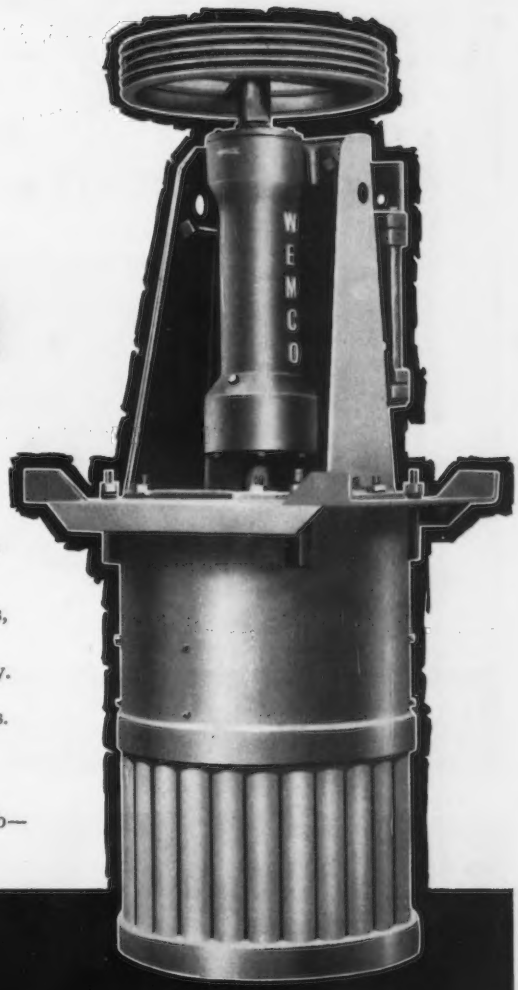

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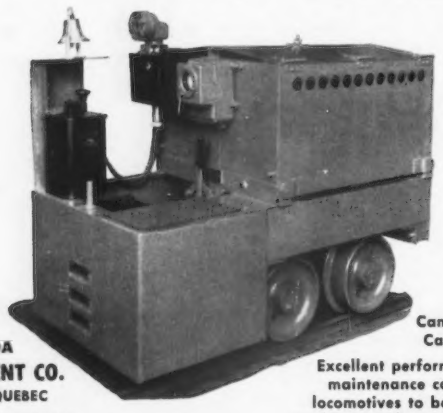

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Obituaries (*from p 104*)

Mining Co., in charge of Idaho operations.

By 1940, Bradley's work was devoted largely to the development of the Yellow Pine mine at Stibnite, Idaho, which during WWII was the nation's largest tungsten and antimony producer.

Bradley had served on the Bunker Hill board since 1938. In 1954, he was named executive vice president of Bunker Hill and the following year was made its president. In addition, he was vice president and director of Pend Oreille Mines & Metals Co.; director, Reeves MacDonald Mines Ltd.; director, American Zinc Institute; and chairman of the board and president of the Lead Industries Association.

An associate said that Bradley was one of the greatest "catalysts" in the mining industry today and his thinking was both national and international in scope. "He was always looking forward both for his company and the industry."

Arthur Joseph Selander, 77, secretary and treasurer of Wasatch Mining Co., Columbus Rexall Mining Co. and Toledo Mining Co. until his retirement in 1953, died November 19 at Salt Lake City.

William Morgan, 69, director, Cia Real Del Monte y Pachuca, and employed by various mining companies in Mexico for the past 40 years, died Oct. 7 at Pachuca.

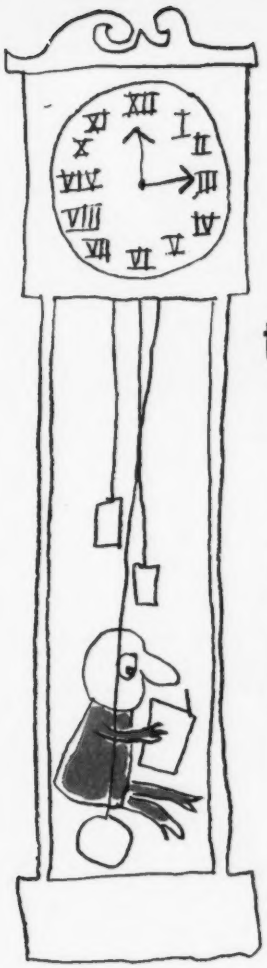
Mr. Morgan graduated from Queen's University, Ontario, in 1915. From 1916 to 1919, he was mine foreman at Morococha, Peru, and, from 1920 to '22, was with the American Smelting & Refining Co. in Parral Chihuahua. For the next five years, Mr. Morgan was mine superintendent for the El Tigre Mining Co., Sonora. In 1928, he joined Real Del Monte, where in his later years he served as director. He is survived by his wife, Naomi D. Morgan.

Dr. Garth W. Thornburg, 40, Phoenix dentist, who pioneered uranium development on Colorado's West Slope, was killed in a hunting accident in a remote area 45 miles southeast of Delta.

Dr. Thornburg and his brother, Vance, developed rich uranium deposits in the Los Ochos mining district of Gunnison and spearheaded construction of a $2-million uranium processing mill in Gunnison.

Roscoe Johnson Whitney, geologist and mineralogist who was a pioneer in the scouting of new mineral areas by low level flying in small planes, died Nov. 5 at his home at Mt. Hag Farm, South Newbury, Vermont. His specialty was pegmatites and he was credited with discovering many new deposits of feldspar, mica, spodumene and other pegmatite minerals.

In 1938-39, Mr. Whitney carried out archeological explorations in Jamaica, Haiti and New Hampshire. During WWII, he was in charge of the mica mining and processing operations in New England for the Colonial Mica Corp. (a U.S. Government agency).



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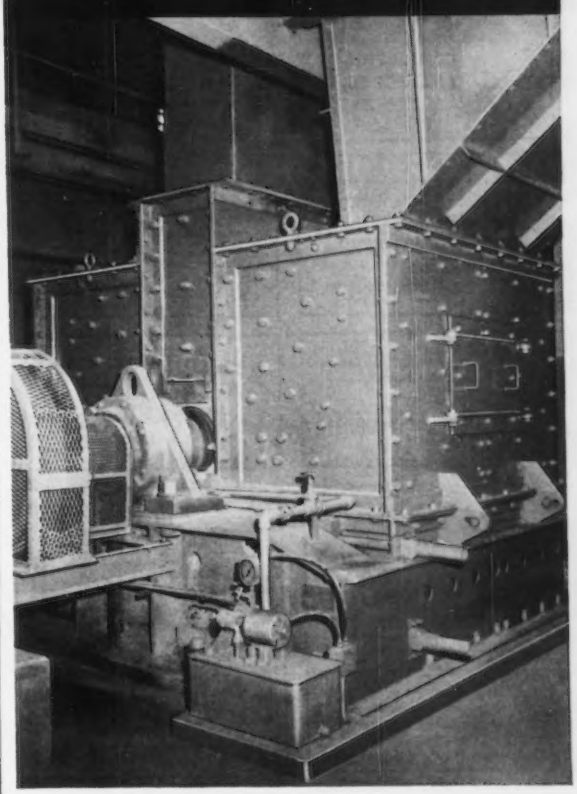

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3—6" x 6" Allis Chalmers, NRLOR, 30 HP motor

Pumps, Sump
2—16" Cascade Sump, 1 Stage, 30 HP motor
1—2" Chicago Pnuematic Sump, Model 346-4600

Sample Cutter
2—Stearns Rogers Sample Cutter with Thrustor

Sand Wheels
4—12'6" x 4' wide Convey Co. Sandwheels, 20 HP Gearmotors

Screen
1—30" dia. x 6' Long Trommel Screen
1—9' dia. x 54'6" Yuba, Heavy Duty, 100 HP
4—4' x 12' Tyler Ty-Rock, 1 deck, F-600, 10 HP

Separator
1—Jig Shot Separator, 12" x 30" Belt Feeder; magnet; screen.

Shaper
1—20" Cincinnati, Utility Model, 5 HP

Shovel and Dragline
1—Model 111 Marion Diesel Electric, 4 cu. yd. shovel front, complete with 100' Dragline Boom and 3½ Esseo Bucket GMC Diesel Engine
1—Model 54-B Bucyrus Erie Diesel, 2½ yd. Buda Diesel
1—Model 170-B Bucyrus Erie Electric, 7 yd. 375 HP Allis Chalmers Motor, 2400/4160 Y & Esseo Bucket

Speed Reducer
1—23½ HP, West., 20-1 Ratio, right angle
1—50 HP, West., 84 rpm
1—75 HP, Falk, 11.5-1 Ratio
1—100 HP, West., 84 rpm

Telephone
1—22 Capacity Automatic Dial, Type 32-A-21

Thickener
1—250' dia. x 14' Dorr Traction Type, Type MC, Less tank, 7½ HP Gearmotor, 220/440 V

Transformers
15—37½ KVA West., OISC, 2400/4160 Y- 240/480
1—37½ KVA West., OISC, 4160/7200- 120/240
27—75 KVA West., OISC, 2400/4160 Y- 240/480
3—100 KVA West., OISC, 2400/4160 Y- 240/480
3—250 KVA West., OISC, 2400- 240/480
1—529 KVA West., OISC, 5160 to 2400
3—833 KVA West., OISC, 55,000 to 2400 V

Vulcanizer
1—J. Heintz, Belt Vulcanizer, Type 48
1—J. Heintz, Belt Vulcanizer, 12" x 14"

Weightometer
1—Merrick, Model E, 36" Belt, with Recorder

Welders
2—200 AMP. GE. 220/440 V. Motor
2—300 AMP. Lincoln "Shield Arc", 220/440 V
2—300 AMP. Lincoln Portable Gas, rubber tires
1—400 AMP. Lincoln Shield Arc, 440 V

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Cars, Mine Ore
1—30 cu. ft. C.S. Card, Rockerdump, 24" ga.
32—33 cu. ft. Ajax Type, 18" ga.
25—60 cu. ft. C.S. Card, Granby, 30" ga.
19—37½ cu. ft. Ajax Type, 18" ga.
14—84 cu. ft. C.S. Card, Granby, 30" ga.
5—85 cu. ft. C.S. Card, Granby, 30" ga.
6—93 cu. ft. C.S. Card, Granby, 24" ga.
7—100 cu. ft. C.S. Card, Side Dump, 30" ga.
14—130 cu. ft. C.S. Card, Granby, 30" ga.

Classifiers
1—36" x 15'-0", Wemco Model SCM, Spiral
1—45" x 17'-3", Akins Spiral w/drive
1—6' x 22' Door Duplex, Rake, w/5 HP
1—7' x 25'-6" Dorr DSFX, Rake Type

Compressors
1—500 CFM Gardner-Denver, HAC, 100 HP, 440 V
1—875 IR XRE 175 HP, Syn. 2200 V
1—1050 CFM G. D., HA, 200 HP, GE 2200 V
1—2000 CFM Worthington, 400 HP, 2300 V
1—2500 CFM Sullivan, WN4, 400 HP, West., 2200 V

Conveyors
1—18" x 14' Pioneer, Steel Frame, 1½ HP
1—18" x 155' Link-Belt, Steel Frame
1—18" x 178' Link-Belt, Steel Frame,

Crushers, Cone
1—3' Symons Shorthead, 75 HP Motor
1—4' Symons, Standard
2—5½' Symons Standard

Crushing Plant
1—Pioneer, Model 40 V, Portable, Complete
1—Cedar Rapids, Pit Master, 10 x 16 Jaw

Engines, Diesel
1—GMC, Model 671 RC, Elec. Start, PTO, 150 HP
1—Duetz, air cooled, Type A12L614, PTO., Exc.

Flotation Machines
1—1 cell Wemco, 44", 5 HP Motor
1—1 cell Denver, #18 Sp, 32" 3 HP Motor
4—2 cell Gallgher, 48", 15 HP Motor
1—2 cell Denver, #21, 38" x 38"
10—2 cell Fagregren, 56" x 56, 14 S.
1—5 cell Wemco, 44", 5 HP Motors
1—5 cell Denver, #18, SP. 32", 7½ HP
2—3 cell Fagregren 56" x 56", 14 s.

Generators, Diesel
1—75KW Caterpillar D-13,000, 220/440 Volt

Hoists, Mine Shaft
1—40 HP Coeur D'Alene Single Drum, Excellent
1—75 HP Puget Sound Single Drum
1—600 HP Vulcan Double Drum, 2300 V, Excellent
1—500 HP Nordberg Double Drum, 22000# pull, 2300 V
1—150 HP Vulcan Single Drum, 24,000# 440 V
2—Bayard, Winches, 12,900 pull @ 38' FPM

Hoists, Slushers & Tuggers
8—15 NNIG Ingersoll Rand, 2 drum, 220/440 V
1—C-111 Sullivan, 1 drum 40 HP, 220/440 V
2—CF211 Sullivan, 2 drum, 50 HP, 440 V
4—A4NNOJ, Ingersoll Rand, 2 drum air
4—HKE Gardner Denver, 2 drum, air
1—K4U Ingersoll Rand, 1 drum, air 3000#
5—HK Gardner Denver, 1 drum, air, 2000#

Jaw Crushers
1—8" x 24" Union Iron Works, 30 HP Motor
1—15" x 36" Universal, 50 HP, G.E. Motor
1—8" x 16" Cedar Rapids, Less Motor
1—10 x 30 Pacific Jaw Crusher
1—10 x 20 Telsmith, Roller Bearing

Jigs
3—12" x 16" Denver Duplex, w/motor
2—26" x 26" Bendalari, Simplex, w/motor
1—42" x 42" Bendalari, Duplex, w/motor

Locomotives
16—1½ Ton Mancha Battery, 18-24" ga.
3—1½ Ton Atlas, Type J, Battery, 18" ga.
1—2½-3 Ton Jeffroy, 18" ga.
1—3½ Ton Mancha Titan AX, 18" ga.
3—Universal Tramaire, Air, 18"-24" ga.

Mills, Rod & Ball
1—3' x 8' Hendy Rod Mill, 30 HP
1—4' x 5' Colorado Iron Works, 30 HP
3—5' x 14' Marcy Ball Mill, 100 HP
1—6' x 16" Hardinge Conical Ball Mill, 50 HP
5—8' x 9' Traylor Ball Mills, 250 HP
1—5' x 8' Traylor Rod Mill, 150 HP
1—5' x 10' Marcy Rod Mill 75 HP Motor

Pumps
1—3" Byron Jackson, Centrifugal Water Pump, 40 HP, 440 V
1—6" Weinman Centrifugal, 1000 GPM, 140' Head, 100 HP, 440 V
3—Allen Sherman Hoff Hydroseal Sand Pump, 4"
1—Ash Hydroseal Sand Pump, Rubber Lined 2"
1—Denver Vertical Centrifugal Sand Pump, 1½

Screens
1—18" x 24" Denver Dillon, w/motor
1—2' x 4' Denver Dillon, w/motor
1—3' x 6' A.C. Aerovibe, Single Deck,
1—3' x 6' A.C. Low-Head, Single Deck
1—3' x 7' Link-Belt, Type PD, 1-Deck
6—4' x 5' Tyler "Hummer", Complete
2—4' x 10' Tyler "Hummer", Complete w/controls

MEXICO

2—Air Receiver 4' x 10'
1—Kewanee Boiler Type C, Series X, 40 HP Approx.

Blowers
1—T-4 Coppus Ventair Blower
4—SP-175 Coppus Vane Blower, air

Cars, 18" ga.
14—60 cu. ft. Card Mine ore cars, Granby
6—13 cu. ft. Mine ore cars, swivel end dump
6—21 cu. ft. mine ore cars, side dump
10—21 cu. ft. mine ore cars, swivel end dump
5—Mine car trucks, 18" gauge

Compressors
2—1075 cfm Ingersoll Rand 6 VO Compressors diesel drive, excellent

Cyanide System
1—Cyanide System Merrill Crowe including clarifier tanks, 36" Shriver presses, pumps, feeders

Crushers
1—24" x 36" Allis Chalmers, Jaw, 75 HP
1—4 ft. Symons Standard cone 100 HP

Conveyors
300'—24" Conveyor belting, 5 ply, new
1—24" x 27' belt conveyor, 2 HP motor
1—24" x 175' belt conveyor, 10 HP motor
1—18" x 27' belt conveyor, 1 HP motor
1—18" x 41' belt conveyor, 2 HP motor

Classifier
2—6' x 27' Dorr duplex classifier, 10 HP

Cranes
1—6 Ton P & H Electric crane, 39'-7" Span
1—3 Ton overhead crane, 32'-8" span

Drifters
12—D-79 Gardner Denver drifters
6D-24 Cleveland drifters

Drills
1—S-55 Gardner Denver sinker drills
3—S-48 Gardner Denver sinker drills
1—J-10 Ingersoll Rand Jackhammer, air
1—Size 5-A Ingersoll Rand Chipping hammer
3—S-91 Joy stoper

Feeder
3—Gerry Reagent feeders, ¾ HP motor
1—42" Ross chain feeder, 3 HP motor

Flotation Machine
1—14 cell, M.S. flotation machine mechanism 10 HP motor
1—8 cell, #24 Denver flotation machine mechanisms, 10 HP motors

Filters
1—6' dia. 8 disc Eimco disc filter, complete
1—6' dia. 4 disc American disc filter, complete

Generators
1—50 KW motor generator set, 250 V. DC
1—60 KW GMC diesel generator, 220/440 V
3—329 Ingersoll Rand diesel generators, 2400 V, complete with switch board and controls. excellent

Hoists
2—E-111 Sullivan tugger Hoist, air
3—HKE Gardner Denver slusher hoist, air
1—100 HP single drum mine hoist, with motor and controls.

Jumbo
1—2 boom jumbo, Cleveland model MDR-228, 18" 99

Locomotives
2—3 Ton Jeffrey Trolley locomotives, 18" 99

Mucking Machines
1—12-BEimco mucking machine, 18" gauge

Magnet
1—32" dia. Stearns suspended magnet 2300 V

Mills
1—5' x 12' Marcy Rod Mill, 125 HP motor
1—6' x 12' Cole Bergman ball mill, 112 KW

Pumps
2—3 x 6 Worthington piston pump, Type KHS, 15 HP motors
1—Size 1½ x 2" Worthington piston pump
1—Novo piston pump, Novo Gas engine
1—2" Denver Equipment Diaphragm pump
3—2" Wilfley sand pumps
2—3" Wilfley sand pumps
1—3" Kimball Krogh sand pump, 15 HP motor
2—2" ASH Hydroseal sand pumps
2—3" Dorrco simplex diaphram pumps
3—6" Denver simplex diaphragm pumps
1—2½ Ingersoll Rand Water pump, 4 stage 150 HP
1—6" Ingersoll Rand deep well pump, 10 HP
1—1½" Roper gear pump, 3 HP
1—3½" x 6 Worthington piston pump, with 2 cylinder GMC Diesel engine.
1—6" Worthington deepwell pump with Johnson gear drive, less motor

Pipe
2500'—6" steel pipe, standard and spiral weld. Victaulic and threaded
1500'—3" steel pipe, threaded
1500'—2½ steel pipe, threaded
6500'—2" steel pipe, threaded

Rail
42 Tons—20' mine rail 15'-20' lengths
12 Tons-25' mine rail, 15'-20' lengths

Sheaves
3—46" dia. card Headframe sheave
9—10" sheave blocks, ball bearing
2—14" sheave blocks, ball bearing

Transformers
3—150 KVA West., Transformers 2300 to 460/230/115
2—3 KVA WEST. dry transformers, 480 to 120/240
3—37½ KVA West. transformers, 2400-240/480V
3—5 KVA West. transformers, 2400/120-240

Tools
1—McGee and Hogan bit grinder, 3 HP, 220/440 motor
1—DF-2 Gardner Denver drill steel forge
1—DS-2 Gardner Denver drill steel sharpener
1—32" band saw, 3 HP motor
1—15" Hermance 4 side wood planer, 25 HP motor
1—34" dia. circular saw, 15 HP, 220/440 V.
1—30" dia. swinging cut off saw, 10 HP, 220/440 motor
1—20" swing Rahn machinist lathe.
1—17" Marvel power hack saw
1—21" Averback shaper, back geared
1—12" Buffalo upright drill press
1—300 amp Wilson portable DC Welder, 220/440 V.

Tanks
1—15' dia. x 10' high Columbian bolted steel
1—29' dia. x 24', Columbian steel water tank
3—21½' dia. x 16', Columbian steel water tanks

Trucks
2—White dump truck, 7 yd. diesel
2—GMC dump truck, 6 yd. diesel

Weightometer
1—18" Merrick Model E. Weightometer

Thickeners
1—40' dia. x 6' Denver thickener, steel tank 2 HP motor
3—40' dia. x 10' Denver Thickener
1—20' x 8 Denver thickener, steel tank

Wire
2000'—#2, single cord. wire, plastic covered
4000'—#4, single cord. wire, weather proof

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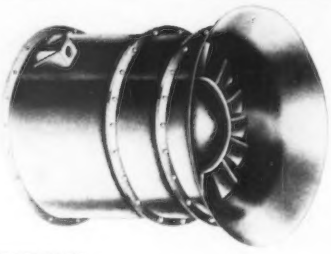
JAW CRUSHERS
5—2¼" x 3½" New Morse Lab Crushers
5—4" x 6" New Morse Lab Crushers
2—5" x 6" New Morse Jaw Crushers
1—6½" x 7" Hendy Jaw Crusher
1—10" x 20" Pacific Jaw Crusher
1—9" x 16" Kue-Ken #30 Balanced Jaw Crusher
1—20" x 36" Diamond Roller Bearing Jaw Crusher.

BALL AND ROD MILLS
1—4' x 4' Hersch Ball Mill
1—4' x 4' Marcy Ball Mill
1—6' x 4' Hardinge Conical Ball Mill
1—64½ Marcy Ball Mill
1—8' x 22' Hardinge Conical Ball Mill
1—3' x 7' Morse New Rod Mill
1—5' x 10' Allis Chalmers Rod Mill
1—5' x 10' Denver Ball-Rod Mill

MINE HOISTS—SINGLE DRUM, ELECTRIC
1—10-HP Vulcan #0
1—15-HP Vulcan
1—20-HP H&B
1—25-HP Vulcan #1½
1—30-HP Vulcan #220
2—40-HP Vulcan
1—50-HP H&B
1—50-HP W. A. Box
1—75-HP Vulcan
1—100-HP W. A. Box
1—112-HP Vulcan
1—150-HP Vulcan
1—150-HP Ottumwa
1—250-HP Ottumwa

MINE HOISTS—DOUBLE DRUM, ELECTRIC
1—75-HP H&B Complete with Steel Headframe
1—75-100-HP, Clutched Drums, Post Brakes
1—82-HP Vulcan #5½
1—100-HP Webster, Clamp & Lane
1—150-HP Jackson

AIR SLUSHER HOISTS
3—A4NNOH Ingersoll-Rand Double Drum Air Slushers
1—HNN1J Ingersoll-Rand Double Drum Air Slusher
1—F-211 Sullivan Double Drum Air Slusher
1—F-212 Sullivan Double Drum Air Slusher



MINE FANS
1—5-HP Joy Axivane Model 1-21
8—7½-HP Joy Axivane Model 18-14-3450
2—20-HP Joy Axivane Model 25¼-17½-3450
1—1½-HP Jeffrey "Aerodyne Midget"
1—2-HP Coppus-Vane Type SM
2—12½-HP American Type HS
1—8H-42" Jeffrey "Aerodyne"
1—7' Jeffrey "Aerovane Junior"
1—10' Joy-Ladel Model L-14

AIR TUGGER HOISTS
8—Ingersoll-Rand Model EUA
2—Ingersoll-Rand Model 10HR
5—Gardner-Denver Model HK
2—Joy Model F113
3—Ingersoll-Rand Model HU
2—Ingersoll-Rand Model 10H
1—Sullivan Model HA3
4—Ingersoll-Rand Model 1H
1—Ingersoll-Rand Model DU
1—Sullivan Model L-111
3—Ingersoll-Rand Model D6U
14—Sullivan Model E-111

ELECTRIC TUGGER HOISTS
1—5-HP Sullivan, Single Drum, Model DE
2—7½-HP Sullivan, Single Drum, Model HE
1—10 HP Sullivan 3 Drum Model A312
4—5-HP Sullivan, Double-Drum, Model HDE
1—15-HP Ingersoll-Rand, Double Drum, Model 15NN-1G
1—30-HP Joy double drum Slusher class B-212
1—60-HP Sullivan 3 drum Slusher class CF-312
1—20-HP Sullivan three drum Model AF-312

VIBRATING SCREENS
1—3'x6' Robins Single Deck
2—4'x6' Allis Chalmers Single Deck
1—4'x8' Robins Double Deck
1—4' x 12' Diamond Double Deck

LOCOMOTIVES—DIESEL
1—4 Ton Mancha Diesel "Trackmaster".

LOCOMOTIVES—BATTERY
1—1 Ton General Electric
2—1½ Ton Mancha "Little Trammer"
1—3-4 Ton GE Type LSB-2C4
1—4 Ton Westinghouse—Baldwin
2—5 Ton General Electric, type LSB-2C5
2—6 Ton General Electric, type LSBE-2C6
1—7 Ton Atlas
2—8 Ton General Electric, type LSB-2C8
1—8 Ton Goodman, type 42C04T
3—8 Ton Ironton, type WO
1—9 Ton Whitcomb
4—10 Ton Atlas, type A
3—5 Ton Atlas

LOCOMOTIVES—TROLLEY
2—4 Ton General Electric, 250 Volts
1—6 Ton Jeffrey, 25 Volts
1—6 Ton Goodman, 250 Volts
1—7 Ton Jeffrey, 250 Volts
2—10 Ton Jeffrey, 250 Volts, type MH78
1—13 Ton Jeffrey, 250 Volts, type MH78
1—13 Ton Goodman, 250 Volts
1—15 Ton Jeffrey, 250 Volts, type MH110

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1—10' x 11' x 175' Vulcan kiln, ¾" shell, 2-tire.
2—7' 6" dia. x 100' long rotary kilns, ½" shell MUST BE MOVED.
1—11' x 155' Traylor kiln, ¾" shell, (2) tires.
1—9' x 175' Vulcan kiln, ¾" shell.
3—10' x 78' Dryers, ¾" shell.
1—10' x 160' kiln, ¾" shell.
1—8' x 115' kiln, ½" shell, (2) tires.
1—7'6" x 100 Kiln, ½" shell.
1—7'6" x 60' Kiln, ½" welded shell.
4—8'8" x 70' Hardinge dryers, ⅝" shell.
1—7' x 50' Allis-Chalmers dryer, ⅝" shell.
1—6' x 50' Louisville rotary dryer.
15—Rotary dryers: 4'9" x 33', 4'6" x 40', 4' x 12', 3' x 15', 2' x 9'.

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1—Kennedy 7' x 9' ball mill 150 HP. (1948)
1—Kennedy 4' x 8' rod, 50 HP., end per disch.
1—Hardinge 4' x16" conical ball mill
4—Allis-Chalmers 5' x 22' ball-tube, 150 HP.
1—Allis Chalmers 6' x 16' ball-tube.
1—Marcy 7' x 15" rod, 300 HP, 4" liners.
3—Jaw Crushers: 20" x 6", 18" x 9", 36" x 15'
1—Kennedy gyratory crusher, #49-S 100 HP.

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CLAM SHELL BUCKETS: One 4½ yd. Owens, heavy duty. One Bucyrus ⅝ yd. hydromucker (Clam shell) with power unit, skid mounted.
JAW CRUSHER-SPECIAL: 42" x 40", V-belt drive, 150 H.P. motor, 42" x 16 ft. heavy duty Feeder.
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CONVEYORS: One 36" and one 42" x 736 ft., complete with all equipment and supporting structure.
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ELECTRIC MINE HOISTS: Single and double drum for shaft and incline, 100 to 1500 H.P.
MINE HOIST MOTORS: One 1250 H.P., 3 phase, 60 cycle, 2300 volt, 444 RPM, with or without controls. Others 200 to 1200 H.P. with controls.
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3 New 25 Ton, 2 GE 1 Whitcomb
3—23 Ton, 2-45 Ton Used Gen. Elec.
1—44 Ton, 1-80 Ton Used Gen. Elec.
1—100 Ton. Also Used New 1955
3—100 Ton. Gen. Motors Used
25 Ton Industrial Brownhoist 55' Boom

MILL EQUIPMENT
2—5 x 8 Air Swept Ball Tube Mills
2—Wemco 2M HMS Plants
2" x 6" Sturtevant Lab. Jaw Crusher, 2 HP motor
3—Jaw Crushers—30"x36", 48"x60" & 56"x72"
Hardinge Mills 4'6"x16", 6'x48", 10'x48"
Rod Mills 6'x12' & 7'x15'
Ball Mills No. 56, 7'x18' & 7'x35'
Classifiers: 78"x36'6" Duplex, 84"x42' Spirals 8'x35'x16' Bowl-rake
Crushers, Fine Reduction: 22" Cone, 2', 3' & 5½' Cone 37½ KVS
2—150 HP 1-200 HP S.D. Elec Hoists
Rotary Dryers; 3'x20', 4'x20', 5'x30' 10'x80'

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1—Size 3GT2 IR Cent. Pump, 500 GPM, 500' TDH; 100 HP Motor.
1—Size 3UC1 Worth. Cent. Pump, 400 GPM, 646' TDH: 100 HP Motor.
1—4-Cell (28x28) D. E. SUB-A Flot. Machine
1—3' x 8' Marcy E.P.D. Rod Mill
1—5' x 9' Kennedy Ball Mill.
1—150 KW Ridgway MG Set, 250 V. DC, 225 HP Motor, 3/60/440.
1—5-Ton Goodman Battery Loco., 36" Ga.
2—8-Ton Atlas Battery Locos., 36" Ga.

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8' x 14' Rotary continuous vacuum Filters. Closed steel panel drums. Rocker agitated troughs. Late style. Excellent condition.

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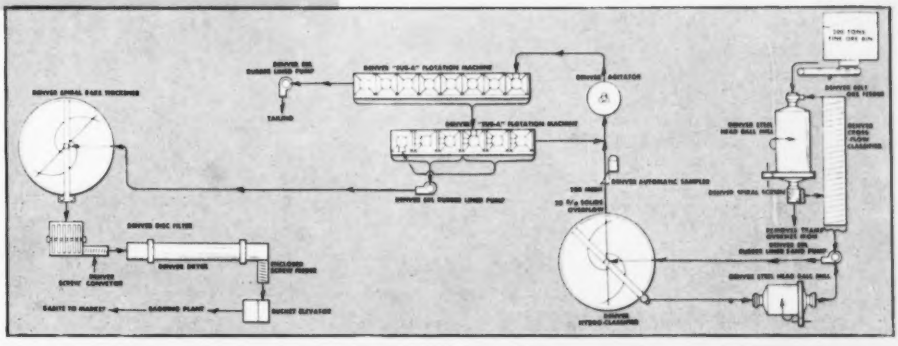

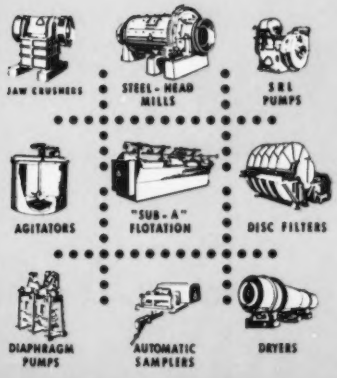

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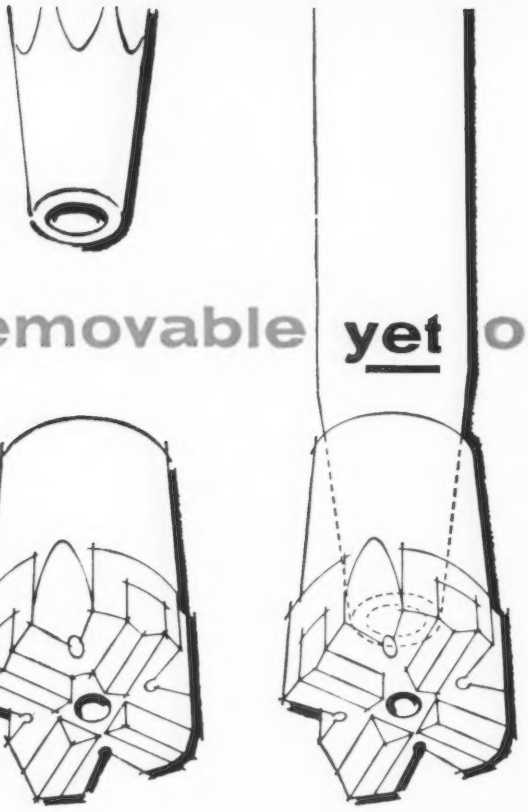

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YOU can keep right on using your good drill steels after the carbides wear out—if you're using Timken® bits. They're removable. Not so with intrasets; you have to throw away good drill steels after the carbides wear out.

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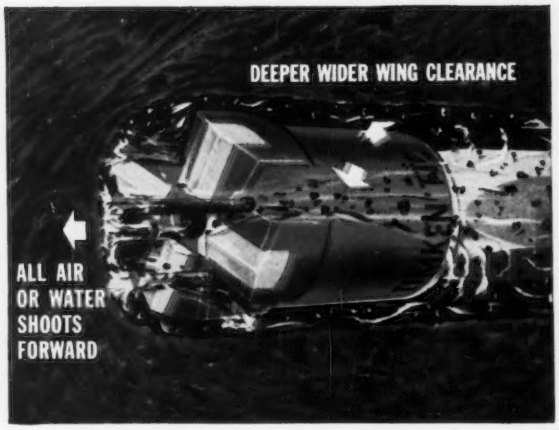

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